THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIX. No. 1515.] LONDON, MAY 24, 1892. [44TH YEAR. PRICE 6d.

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See Advertisement, p. 945.

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SELF-CONTAINED DUST-FUEL FURNACE.
MELDRUM'S PATENT.

Extract from the *Smethwick Telephone,* June 13, 1891.

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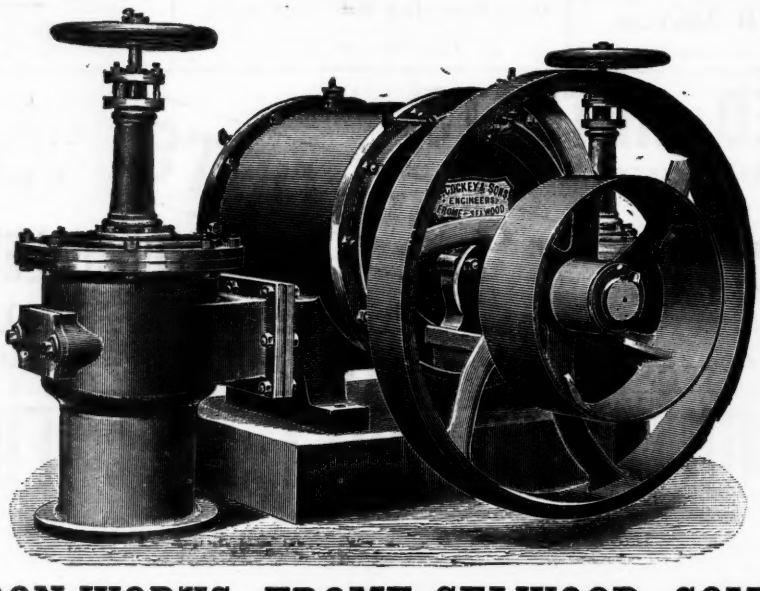

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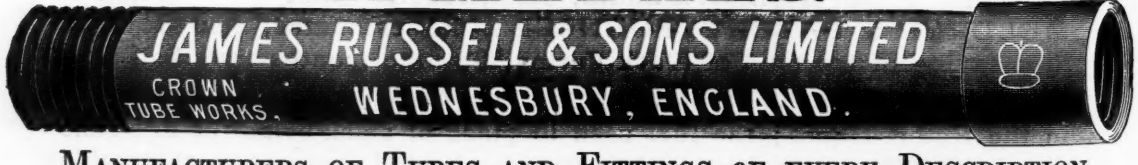

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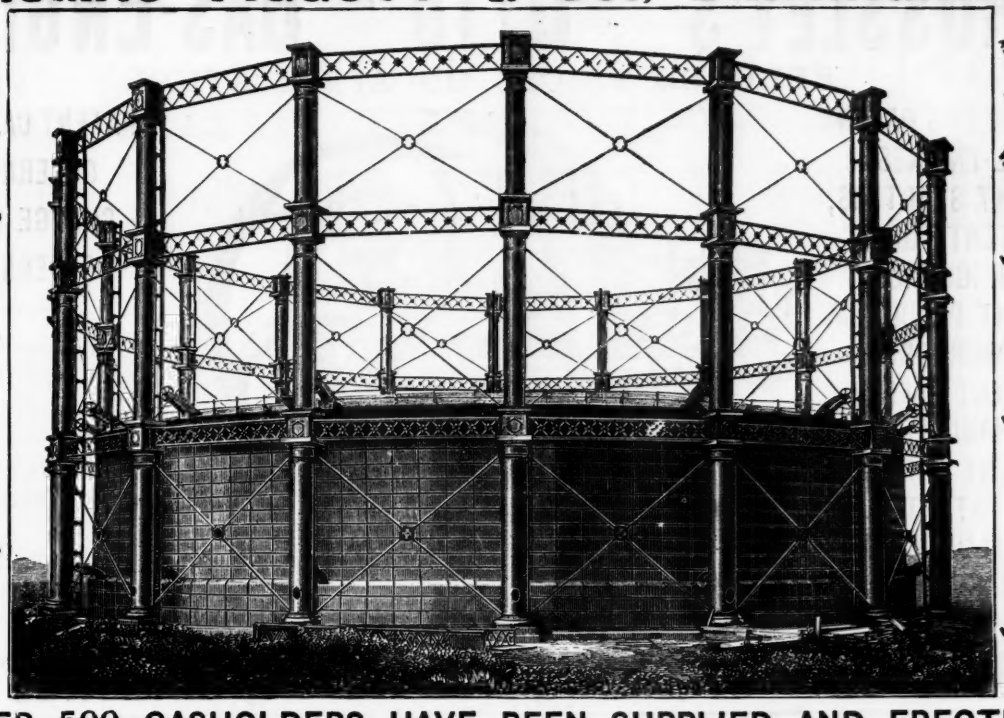

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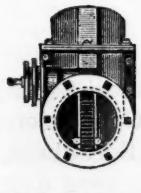

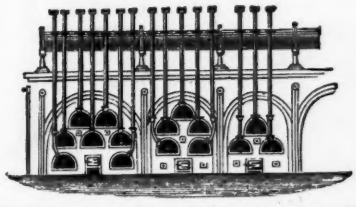

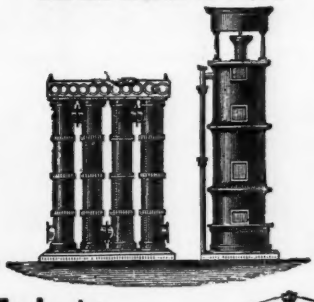

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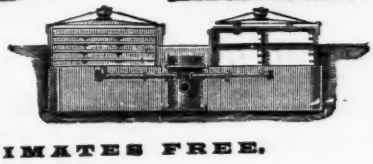

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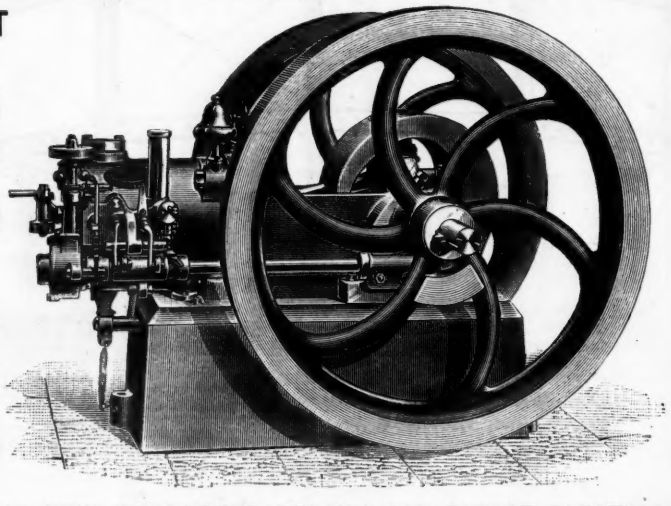

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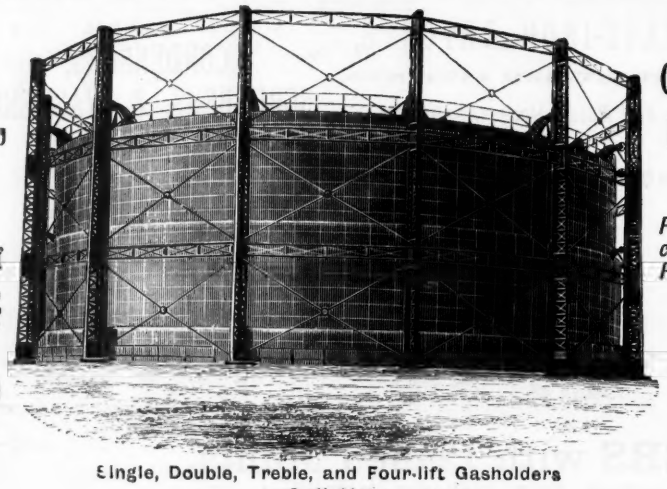

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Perfectly automatic, and cannot get out of order. Prices low. All particulars on application.

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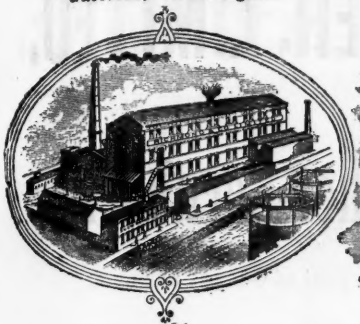

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Erected and in course of construction at present date.

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Beckton	3,500,000	Dover	1,000,000	Barry and Cadoxton	500,000
,,	3,500,000	Colchester	1,000,000	Workington	500,000
Kensal Green	3,000,000	Cambridge	1,000,000	Lowestoft	500,000
,,	3,000,000	West Bromwich	1,000,000	Newton-le-Willows	500,000
Liverpool	3,000,000	Luton	1,000,000	Manchester	400,000
,,	3,000,000	Alger (Algieria)	875,000	Erfurt (Germany)	400,000
Croydon	3,000,000	Valencia (Spain)	875,000	St. Chamond (France)	350,000
West Ham	3,000,000	Barcelona (Spain)	875,000	Santander (Spain)	350,000
Rochdale	3,000,000	Nice (France)	875,000	Atlas Steel Works, Sheffield	250,000
Paris	3,000,000	Stockport	800,000	Bangor	250,000
,,	3,000,000	Magdeburg (Germany)	750,000	Lille (France)	250,000
Glasgow	2,500,000	Altoona (U.S.A.)	750,000	Melun ,,	210,000
,,	2,500,000	Smethwick	750,000	Valencia (Spain)	200,000
Manchester	2,500,000	Schneider-Creusot Works		,, ,,	200,000
Leicester	2,250,000	(France)	735,000	Vercelli (Italy)	200,000
Swansea	2,000,000	Valparaiso (Chili)	600,000	Rawmarsh	200,000
Bordeaux	2,000,000	Halle (Germany)	600,000	Baccarat (France)	175,000
Melbourne	1,500,000	Elberfeld ,,	600,000	Hitchin	150,000
Charlottenburg (Germany)	1,500,000	,, ,,	600,000	Sydney	100,000
Derby	1,500,000	Nancy (France)	525,000	Balson-Chateauroux (France)	70,000
,,	1,000,000	,, ,,	525,000		

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Birmingham	5,000,000	Hastings	1,500,000	Heckmondwike	500,000
Nine Elms (in part)	3,000,000	West Ham	1,500,000	Hampton Wick	500,000
Vauxhall ,,	3,000,000	Nottingham	1,500,000	Kingston-on-Hull	400,000
Dublin	3,000,000	Melbourne	1,500,000	Weston-super-Mare (in part)	400,000
Shoreditch (in part)	2,500,000	,,	1,500,000	Enfield	300,000
Beckton	2,500,000	Crewe (L. & N.W.R. Co.)	1,250,000	Harrow	250,000
Manchester	2,500,000	Beckton	1,250,000	Buxton	250,000
Bromley	2,000,000	,, (in part)	1,250,000	Quebec, Canada (in part)	250,000
Pimlico (in part)	2,000,000	Bradford	1,250,000	Newmarket	150,000
Plymouth	2,000,000	Maidstone	1,000,000	Leominster	150,000
Croydon	1,500,000	Smethwick	750,000	Kidsgrove	100,000
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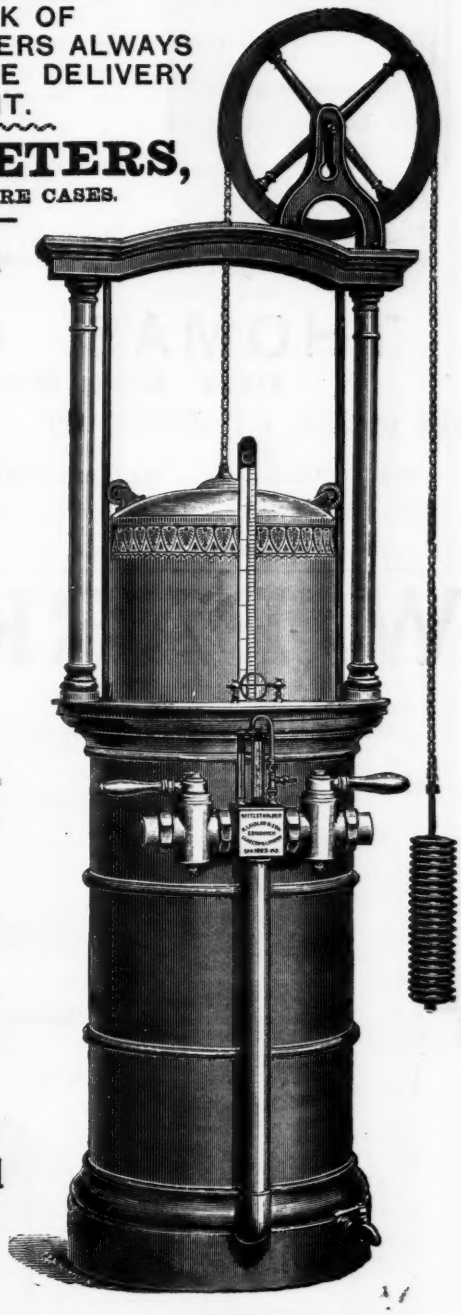

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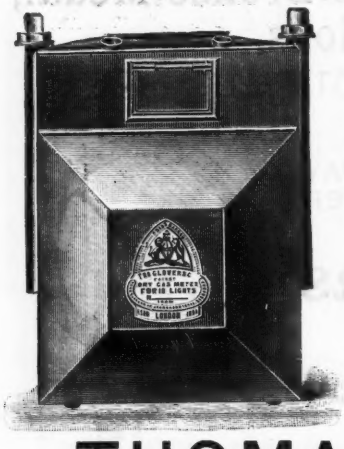

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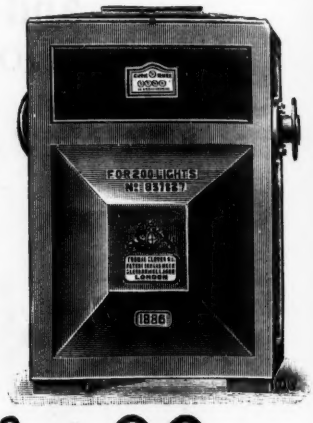

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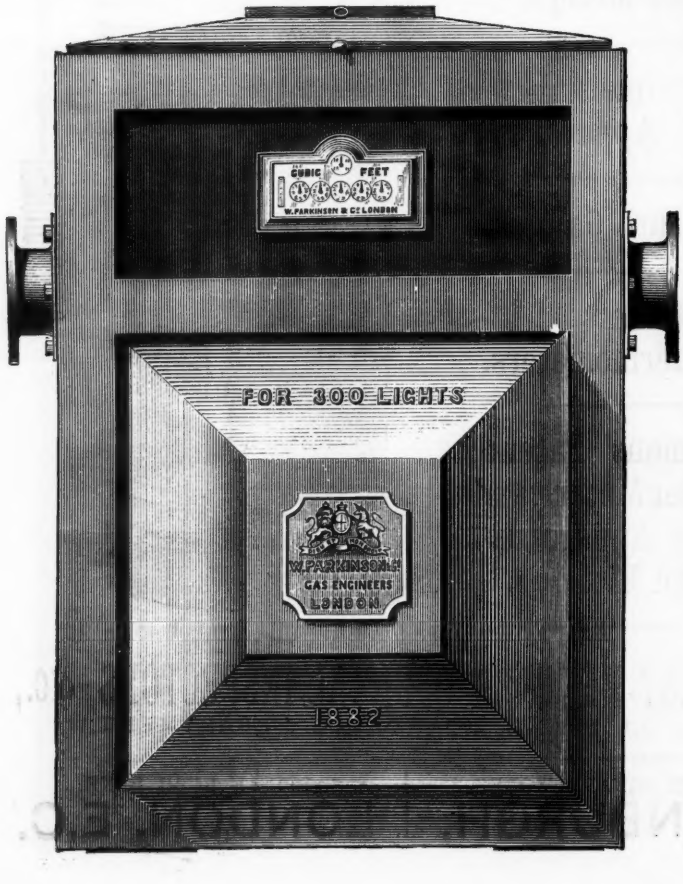

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 24, 1892.

The Institution of Gas Engineers' Papers.

IN another column will be found the first portion of our report of the discussion upon the papers read at the recent meeting of the Institution of Gas Engineers. We give the whole of the discussions relating to the first day's papers, and the rest will follow next week. As will have been seen by our report of the proceedings in the last issue of the JOURNAL, the first day of the meeting was appropriated to the delivery of the President's Inaugural Address and the reading and consideration of Mr. George Livesey's paper upon profit-sharing, and the four oil-gas papers by Messrs. Browne, Lewes, Lacey, and Pryce. Before going on to comment upon Mr. Livesey's paper and the discussion which it evoked, we have to repair an error in our review of Mr. Hunt's address. It is a small matter, in itself, and relates only to his and our attempts to trace—in both instances, probably, by recollection, and without reference to authority—the origin of the phrase "decre-"mental rate of increase" as applied to the business of a gas company. It has been brought to our notice that, while Mr. Hunt was wrong in ascribing the formula to Mr. George Livesey, and also in putting his own interpretation upon it, the contemner of the phrase was not Lord Grimthorpe, as we supposed, but Mr. Matthews, Q.C., the present Home Secretary, who thus quashed, with a contemptuous sneer about "arithmetic gone mad," some elaborate tables relating to the Birmingham gas arbitration which had been prepared by Mr. Price-Williams. The incident is a trivial one; but it goes to show how difficult it is to write history accurately, when events and sayings are put down at third hand.

Mr. Livesey's paper was a very worthy production by the author of the sliding-scale profit-sharing scheme for gas workers; and it will remain upon record as an authoritative sketch of one way in which an industrial copartnership may be built up. The author would himself admit that it might rather be described as the first word upon this subject than the last; and he is not at all likely to claim more for his economic invention than the obvious result that "it works." To make a machine that goes is the first object of an inventive mechanician. The improvement of the output, the reduction of friction, and the simplification of principles come later. Steam motors had already changed the face of the world before Sir Frederick Bramwell drew up the first thermic balance-sheet, to exhibit the duty performed for the fuel expended. So with profit-sharing, as a contribution towards the solution of the modern puzzle of the Sphinx, credit is due in no unstinted measure to the men, whoever they are, who try what can be done while their fellows are still criticizing the order of their proceedings. The discussion, if such it may be called, upon Mr. Livesey's paper went to show what might have been supposed before—that the very idea of profit-sharing has not yet penetrated the minds of such an auditory as the author addressed on this occasion. It is possible that among those engineers and managers of gas-works who said least about the paper, or who remained silent, there may have been some who have thought deeply on the subject of the relations of Capital to Labour, but were prevented, by various considerations, from speaking out. But the general impression created by the speakers was unquestionably that of a failure to realize the nature of the problem, betrayed by a muddling of the nominal question with all sorts of things that have nothing to do with it—sick allowance, pension funds, premiums on working results, and so on. Now, as we understand it, the motive of profit-sharing is this: Under the wages system, the capitalist goes into the labour market and buys a recognized amount of work at the current price. To this transaction the maxim *caveat emptor* applies as fully as to a purchase of eggs. The buyer has to see to it that he gets his money's worth. The seller has no interest in rendering any more value for the price than he can help. The buyer has a motive in buying his labour, which is, to make a little more out of it than it costs him—the difference being his profit. Well, now, in the ordinary way, taking all the buyer's risk of bad bargains, and the burden of keeping his labour up to the mark, the employer looks to make an average profit of (say) 5s. upon every pound he lays out weekly in wages. But suppose that, by enlisting upon his side the labourer's interest as well as his bare toil, the employer might reasonably expect to increase the efficiency of the workman as a money-making agent—what should he pay for this interest? Practically, profit-sharing simply means the employer saying to his man: "If you will work for me, not as a hireling, but as you "would for yourself, I will make it worth your while." Does anybody doubt that there is a difference between the hireling and the man who is working for himself? Then the only question that remains is, how to apportion the benefit.

This difficulty appears to be a very dreadful one to anybody who has never cared to face it; but once persuaded as to the desirability of profit-sharing—which is a point as yet far beyond Mr. Livesey's recent audience—there is good

hope that employers may be able to initiate many plans for carrying their conviction into effect, among which the best would soon show themselves by natural selection. Many artificial obstacles were raised, in the discussion upon Mr. Livesey's paper, to the idea of sharing profit with workmen, by speakers who, unlike others, knew well enough the essential distinction between profit-sharing and the other devices of pensions, &c., mentioned, none of which ever secured the interest of the workman. A favourite query of this order of critics is, How does the coal-trimmer or the road-sweeper contribute to the profits of the undertaking in which he is employed? And another is, Why should the workman share profits when he cannot bear losses? To the first question, it would suffice to quote the majestic words of Milton, which sweep away all distinction of quality from a common service—

> "Thousands at His bidding speed,
> And post o'er land and ocean without rest;
> They also serve who only stand and wait."

While to the latter it may be replied that the workman does, as a matter of fact, suffer from the loss of his employers in ordinary cases, even to the extent of total deprivation of his means of livelihood. When, in a less accommodating age than this, the journeymen makers of shoe-buckles starved as a consequence of a shift of Fashion, did they not bear the brunt of the loss? But truly these objections are more dialectical than conscientious. The only real difficulty attending the adoption of profit-sharing is the twofold one of finding the just datum and defining the shares of Capital and Labour respectively. As to this, the most hopeful way is to try something that appears reasonable while waiting for the perfect rule that may be developed by experience.

With regard to the oil-gas papers, there is little to say here; the subject having been so thoroughly ventilated at the meeting. There remains a considerable disagreement between Mr. Browne, of Rotherhithe, and the proprietors of the Maxim-Clark system of carburetting gas by petroleum spirit, as to the efficiency of this material; and Dr. Dvorkovitch has left a very important point open with regard to the possibility of obtaining a valuable residual from oil gas. The discussion upon the general subject was, on the whole, pointed and informing, and quite justified the Council of the Institution in making gas-carburetting methods so prominent a division of the technical work of the meeting.

The Gas Supply of Birmingham—A Lesson to Miners.

THE annual report of the Gas Committee of the Birmingham City Council for the past municipal year shows that the dual undertaking is progressing; and that both the head-quarters works require extension. The balance carried from the revenue to the profit and loss account is £114,170, out of which there remains—after providing for all capital charges—what is called a net profit amounting to £22,144. In order to obtain this sum, which is to be appropriated to the improvement rate for 1891, the Committee have suspended the payment for the year of the usual allocation towards the sinking fund, excusing themselves by referring to "the large sum which was "appropriated to this fund from the profits of the previous "year." The manœuvre may be a perfectly harmless and justifiable one; but that it should have been done is a good illustration of the elasticity (to call it by no harsher term) which marks the treatment of capital obligations by local authorities. The Committee have decided against undertaking the manufacture of sulphate of ammonia, and they are now inviting tenders for the purchase of their ammoniacal liquor for a period of ten years from June, 1893. It is to be presumed that the Committee have good and sufficient reason for thus deciding against following the course which has been forced upon so many gas-works administrators; but unless purely local considerations alone have weighed with them in this matter, it would be instructive to learn why they prefer to sell their liquor instead of working it up themselves. It appears that the Birmingham Gas Committee—possibly upon general principles—are averse from doing more for themselves than they can help; and they have accordingly renewed their main and service-laying contract with Messrs. John Aird and Sons for another period of five years. One portion of the report deserves the particular attention of labour agitators, by the light it sheds upon the reason why strikes of miners to force up the price of coals do not succeed. It is stated that the Committee received notice at the time from the colliery-owners supplying coal under the current year's contracts, that they would be unable to continue deliveries during the recent stoppage of mining. It consequently became necessary to purchase additional coal in anticipation of the cessation of supplies; and 12,000 tons of coal were, in fact, purchased for delivery during the fortnight preceding the stoppage, of which 9000 tons were delivered during the time stipulated. For these additional supplies, prices in advance of those given under contract had to be paid; but it should be noted that none of this extra money could by any possibility reach the pockets of the men who by their determination to "play" for a week rendered the expenditure necessary. On the contrary, these victims of a rash experiment had to pay for the lesson of failure; for "on the resumption of work by the "miners, the Committee informed their contractors that, "having made these additional purchases, they were not "in a position to receive, as arrears on the contracts, the "coal which should have been delivered during the cessation "of work." There is more point in this brief statement, and more instruction, than in all the frothy harangues of all the demagogues whose blatant ignorance ever darkened the counsels of a Trade Union. The report also states that, having regard to the yearly increasing difficulty of getting cannel, the Committee have turned their attention to oil for carburetting their gas, and have arranged for an experiment with carburetted water-gas plant.

Manchester Gas.

THE Manchester gas consumers are dejected, as well they may be, by the persistent refusal of their local masters to do them even an instalment of justice in the matter of lowering the price of gas. They begin to understand how hopeless their condition really is, and must continue to be while the spending departments of the Corporation are able to combine for the purpose of outvoting the Gas Committee. All these interests are against them. However feeble may be the mutual attachment between the corporators who are of the Ship Canal party and their fellows who desire cheap electric lighting, they can sink their differences, and vote as one man, upon the desirability of maintaining the indirect tax upon the gas consumers. Of course, they are all honourable men, as Mark Antony said of the murderers of Cæsar; but they work their will all the same. True to one of the most remarkable tendencies of human nature—which is to talk of feasts when one is starving, and picture to oneself the charms of running water while dying of thirst—the Manchester newspapers are entertaining descriptions of the uses of the natural gas of America, and publishing letters on the subject of the possibility of making fuel-gas in this country. This is all very nice in its way; but it would be a pity if such loose writing upon this topic as usually finds its way into the newspapers, should distract the minds of the gas consumers of Manchester from the point, which is that the only gaseous fuel they are ever likely to get must come from the mains of their own Gas Department. We see that one gentleman, who belongs to the order of those who know so much better than technicians that they are "amazed" at the "persistent refusal" of the latter to follow them in their airy flights of fancy, has written to a Manchester paper stating, as a fact, that "every ton of slack will "yield 100,000 cubic feet or more of heating gas, "and coke worth at least 5s. From the gas can be "extracted, even at the present low prices, 5s. worth "of tar, ammonia, and benzol. The cost of slack, "labour, and interest upon capital will not exceed 9s. "per ton; so that the gas will cost less than nothing, "and yet do more work than the coal from which it is "produced." The imagination reels before the vision suggested by such a wealth-creating system of fuel-gas manufacture as this individual has in view; but it may be hinted that, as there is nothing like being quite sure of one's ability to make something out of nothing before going into the business on a large scale, the gentleman should try the experiment of taking a week's holiday in London, starting from Manchester with £10 in his pocket, and returning home, after having thoroughly enjoyed himself, with rather more money than he began with. Seriously, however, there is no way out of their trouble for the gas consumers of Manchester except by the City Council elections. The Corporation

have arrived at the point of disclaiming any desire to make a profit out of their nascent electric lighting scheme; and why they should treat their gas undertaking differently is a secret which is locked in the aldermanic breast. It cannot be because the electric light is to be the luxury of the rich, and must therefore be sold at cost price, while gas is, or should be, the light of the poor, and may consequently be taxed to the limit of endurance.

The Tricks of the Exciseman.

THE deeply interesting problem as to whether a gas-liquor still is a "still" within the meaning of the statutes under which the Inland Revenue of the United Kingdom is collected has been mentioned in Parliament; Sir H. Roscoe having addressed to the Chancellor of the Exchequer a question upon the subject, which was so couched as to imply that the action of the Excise authorities in prosecuting the Sunderland Gas Company for keeping a "still" without a licence was vexatious, and unreasonable. Mr. Goschen, in his reply, was able to screen himself behind the highly convenient defence that the question of sulphate of ammonia stills is to be stated in the form of a special case for the consideration of the Queen's Bench Division; and he merely remarked that, in the opinion of the Board of Inland Revenue, these stills are capable of being used for the production of spirit. Of course, since such is the official opinion, it is only right that action should be duly taken upon it; but it is at least noteworthy that the Excise authorities should have required thirty years to consider the question. We must follow the Chancellor of the Exchequer in refraining from pronouncing any opinion respecting the legal right or wrong of the Excise action; but the manner in which this attack has been sprung upon the unsuspecting practitioners of the harmless art and trade of sulphate of ammonia making is at least open to comment. Fancy an ardent total abstainer, who would as soon dream of harbouring an illicit still in his works as he would of keeping a whisky bottle in his desk, hauled up before the local Magistrate upon a charge which, in theory at least, brands him as worse than a smuggler! The clumsy, high-handed way in which the Inland Revenue people treat the community even now is a reminder and an explanation of the bitter dislike with which the "gaugers" were regarded by the public in the old smuggling days, when the "free-traders" were far surer of sympathy from the mass of the population than the agents of the law. Times change, but the exciseman remains; and having no bold "Smuggler Bill," like him of the "Ingoldsby Legends," to circumvent, the gauger fastens upon the gas manager, who is a much easier prey.

General Supply Companies.

GAS undertakings, especially when owned by enterprising local authorities, are expected now-a-days to blossom out into many strange developments. They bear fruit even in the shape of hotels, baths and washhouses, free libraries, recreation grounds, electric lighting and locomotion—indeed, we should fill a column with a mere catalogue of the objects which a prosperous gas undertaking is made to serve in the United Kingdom and on the Continent. In America, the facts are stranger still—only with a difference; for whereas in England we have many local authorities who are said practically to own gas-works, in the States the relationship is changed, and the local authorities there are often owned by the gas undertaking. In all cases, however, it is the gas making which pays, and from which the various developments we have referred to draw their sustenance. From news that comes through an American journal, we learn that what gas undertakings do out of their superfluity, some electric supply companies in the States have found it necessary to do for a living—that is, embark on all sorts of subsidiary businesses so as to make a dividend. There is a good deal of charm about this free sort of commercial adventure, which is as different from the staid experience of a British statutory gas company as was the career of a "letter of marque" from the duty of a Thames steamboat. It requires a truly handy man, an engineer of resource, and a good man of business, to manage an Omnium Supply Company of this type; whereas it has sometimes been made the reproach of a British statutory gas undertaking that it can manage itself. We have never subscribed to the popular error that a gas undertaking can do without good management, even when it belongs to a local authority; but there can be no questioning the conclusion that if the gas undertakings of the United Kingdom had not had the way to their maximum dividends made so easy by legislation, their owners would have been forced to rely more obviously upon the skill of their managers, which would have been better for the latter in the long run.

WATER AND SANITARY AFFAIRS.

SITTING for two days last week, the Royal Commissioners appointed to inquire into the Metropolitan Water Supply took evidence from witnesses brought forward by the New River and East London Companies. There is now an adjournment until next Monday; to be followed by sittings on the ensuing Tuesday and Wednesday. According to present arrangements, it is probable that the first witnesses at the adjourned meeting will be gentlemen appearing on behalf of the Lea Conservancy Board; after which the Commissioners will proceed to hear others representing the Companies drawing their supplies from the Thames. We hope the Kent Company will not be left till the last. The evidence given by the two Companies connected with the Lea Valley, as to the future development of the supply obtainable from deep wells in the chalk, is so important and so striking in its character, that it seems desirable to have it followed up at once by the reception of evidence from a Company wholly dependent on such a source for its supply. The circumstance that a large portion of the Kent district lies below London does not materially detract from the importance of evidence relative to the underground flow of water in that area, and we must trust that the subject will receive the attention it deserves. In the last annual report of the Local Government Board, Major-General Scott discusses the question of the chalk wells at considerable length. He remarks that "the Kent Company have "been most successful in finding water in the chalk." But he says: "It has not been possible to obtain "information with reference to the effect of the annual "abstraction of this large quantity of water on the level of "saturation in the chalk or the flow of springs." Added to this we find the suggestive observation: "There can be "little doubt that data exist which would afford valuable "information on this most important question." In General Scott's opinion, "the lowering of the level of "saturation, the diminution of the flow of natural "springs and of streams fed by springs, and increase "in the aridity of the surface, must necessarily be "in progress." The effect, at present, it is admitted, may be small; but the issue is of such a nature that General Scott concludes by saying: "It is hardly neces-"sary to point out that it is of the greatest importance "these matters should be thoroughly investigated." It is in the power of the Commissioners to effect this thorough investigation; and although the Kent Company may be to some extent isolated from the other Metropolitan Water Companies by the exclusive character of its supply, the Directors of the Company can scarcely fail to see that, in the present state of affairs, there is a common bond of interest uniting all the Companies, and rendering valuable every piece of evidence which goes to show the amplitude of the resources available for the supply of the Metropolis without superseding the present system. That such evidence can be given from the Kent district, is what we have every reason to anticipate.

In connection with the foregoing remarks, we would call attention to the statement mentioned in the midst of Mr. Francis's evidence, by Lord Balfour of Burleigh, the President of the Commission, that two artesian wells belonging to the Cheshunt Local Board had been drained by the pumping operations of the New River and East London Water Companies. The extent of the alleged depletion appeared to be a fall of 50 feet out of 150. Mr. Francis was, however, able to quote the Surveyor to the Board, as saying that a new well belonging to that authority was entirely unaffected. The President nevertheless went on to observe that "it was said" many of the rivers in the county were much diminished in volume. We mention these points as showing the apprehension which exists on this subject, though the President merely referred to the statements, and did not in any way endorse them. Mr. Francis was able to bring very positive evidence to

bear, showing that the pumping operations of the two Companies had not exercised any injurious effect. A considerable falling in the level of the water under London was admitted, as also some decrease of water in the upper valley of the Lea; the latter result being due to the increase of land drainage, which, of course, likewise produces floods. Sir Frederick Bramwell spoke of an underground flow of water, at a considerable depth, which was on its way to "a waste exit" lower down the river or into the sea. In like manner, Mr. W. B. Bryan, the Engineer to the East London Company, expressed an opinion that there was an immense volume of water running to waste in a south-easterly direction towards Purfleet and Grays. The idea that deep wells in the chalk must necessarily drain the rivers, is not so absolutely assured as people generally suppose. The subject is well handled in a pamphlet on "The Supply of Water to "London," by Mr. J. Logan Lobley, F.G.S., who states that most of the water which has fallen as rain on the absorbent chalk at a considerable distance from a stream "will descend to lower levels than the stream, and so never "find its way into it by springs." Hence it follows that a very large amount of water may be taken from the middle and lower beds of the upper chalk, or the chalk with flints, with little effect on the volumes of the rivers of the chalk areas. Viewed in this light, the proposal that the New River and East London Water Companies shall, in the course of the next forty years, draw from their wells 44 million gallons per day more than they do at the present time, need excite no alarm whatever. These Companies can likewise take as much water as they please from the Lea, providing they leave enough for the navigation. The East London Company can also draw 10 million gallons per day from the Thames at Sunbury. If the other Companies can show as good a case as these two, the Commissioners need not be long at their task.

After the lapse of seven years, the Earl of Camperdown has revived his Bill for the regulation of the powers of the Water Companies. The measure has reference to all England; but has no application where the water supply is in the hands of a local authority. The main object of the Bill is to limit the power of cutting off the supply when the consumer fails to pay. It appears that more than a dozen clauses are considered necessary to protect the consumer in case of his having a quarrel with his water company. The Bill, subject to some modification, has passed through the Committee stage in the House of Lords; and will probably meet with the same fate as its predecessor in 1885, when, as Lord Camperdown says, the Bill "was lost in the other House owing to the pressure "of business." Of course, if the measure became law, it would cease to operate on the London Water Companies immediately the Metropolitan Water Supply passed into the hands of the London County Council. As the Bill appears to be chiefly aimed at the London Companies, we may presume that Lord Camperdown does not calculate on their early extinction. Legislation on the water question is in a critical state at the present time, and, as affecting the London Companies, is singularly inopportune, seeing that a Royal Commission has the subject in hand. The London County Council has felt the necessity of withdrawing the clause in its General Powers Bill by which that body was to be empowered to continue inquiries and conduct negotiations in relation to the Metropolitan Water Supply, and to take part in promoting Bills relative thereto. Even the London Water Bill has undergone modification, to the extent of providing that no contract entered into by the County Council for the acquisition or taking on lease of any of the powers or undertakings of a Water Company shall have effect unless and until the same shall have been sanctioned by Parliament. There is a little tinge of modesty here; and the amendment has been announced as "important." It might have been called inevitable. The most proper amendment would be the extinction of all the clauses, for, as set forth in the petition presented by the seven associated Water Companies against the Bill, the measure is not conceived in the interests of the public, but as a means whereby the Council may attack the Companies, and depreciate the value of their undertakings. The Bill is an assault on property, and already puts the Companies to a large expense, in addition to what they will have to bear as extensive contributors to the rates. The Select Committee presided over by Sir G. Pease yesterday considered the Bill.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, MAY 11 & 12, 1892.

Mr. CHARLES HUNT, M.Inst.C.E., President.

DISCUSSIONS ON THE PAPERS.

In the JOURNAL last week (pp. 896-912), we gave the whole of the papers read at the above meeting. To-day we commence the report of the discussions thereon, in the order in which the papers were taken.

MR. G. LIVESEY'S PAPER ON PROFIT-SHARING.

Mr. C. EASTWOOD (Linacre, Liverpool) said the question discussed in the paper was a very important one, and one which was coming more and more to the front. He had some little acquaintance with the subject; and, coming as he did from a place where there had been scarcely any dispute with the men, and where there was in existence almost everything to which Mr. Livesey had referred, he could give some corroboration of his suggestions. In Liverpool they had never had to deal with a twelve-hour shift. For forty years the stokers had worked the eight-hour shift successfully. They found no difficulty in burning off the charges in the retorts in four hours; and they obtained as much work out of them in 24 hours as anyone else. It was simply a question of the heating and arrangement of the retorts. The question, therefore, was not eight hours *versus* twelve, but whether or not an adequate amount was paid for the work done. At Liverpool it was all hand labour—there was not a machine in the place. The stokers' wages were, in round figures, 2s. 8d. per ton; and this included all the labour belonging to the carbonizing department. The men would bring in the coal, put it into the retort, draw the charge, take the coke out to the yard to the slaker, and attend to their furnaces; and the price paid for this was 2s. 8d. per ton. Again, for upwards of 25 years, they had had a savings deposit fund for the workmen. It was an old custom with their men, if they had any savings, to invest them with the Company, who had allowed them throughout the entire time interest varying from 3½ to 4 per cent. These amounts were deducted weekly from the men's wages, but with their consent. When the wages were entered in the wages-book, there was a separate column for the amount any man wished to leave. The ticket given to each man with his money showed the amount so put in the fund for him; and it remained there as long as he pleased. Only recently, at his own station (Linacre), several hundreds of pounds were drawn from the savings fund by some of the men, and invested in the shares of the Company, which were bought by auction, not by allotment as in London. There was no sulking with the men, who had entire confidence in the Company. Only a few weeks previously, one man had left to him a little fortune of £200, which he brought to him (Mr. Eastwood) to invest in the same way. They had therefore gone in the direction indicated in the paper respecting the savings fund, which seemed to him to be the kernel of Mr. Livesey's scheme. Only, instead of profit-sharing, they paid the men fair wages for the amount of work they did; and the men had their profit week by week, and were not dependent upon any other circumstances. What he should like to see was, not that the profits should be shared on the general success of the undertaking, but in proportion to the success due to the stokers in the retort-house. One thing of importance, in connection with this, was that the labour of these men was a very small matter indeed compared with the cost of the material with which they had to work. In dealing with a ton of coal, the question whether or not they produced 10,000 or 11,000 cubic feet of gas from it, depended very much on the way in which it was handled in the retort-house; and the stoker would have more incentive to work if he were paid in proportion to the quantity of gas he made from a certain amount of coal, instead of on the general profits. He had also an inducement to attend to his fire, to save fuel and coal, which he would not understand when he was

dealing with the profits of the concern. He (Mr. Eastwood) rather feared that this wages question was one applying to workmen all over the country. There seemed to be a general upheaval of labour—not confined merely to the gas industry. Whichever way they turned, there was an attempt on the part of the working classes to obtain a larger amount of the profits arising from industrial pursuits. No one could object to that, as this was a free country, where a man sold his labour for what he could get; and if a man said he would not work for an employer for less than 10s. a shift, the employer must pay him this, if he could not do without him, or else bring in machines. But, after all, there must be someone finally to do the work; and as long as this was a free country, one could only get from a man just the amount of work he was disposed to give in return for his wages.

Mr. LIVESEY asked Mr. Eastwood if he allowed his stokers any bonus for making 11,000 cubic feet of gas per ton of coal.

Mr. EASTWOOD said he did not. The coal was weighed out to them. He might say that, in certain retort-houses, the usual weight was 2 tons per man; anything beyond this was paid for at the rate of 1d. per hundredweight. The consequence was the men generally took £1 19s. 8d. per week of seven shifts.

Mr. C. E. BOTLEY (Hastings) said that the paper was certainly one of great importance; and all who had charge of gas undertakings, especially in the South, where the conditions of labour had been very unsettled, would agree that any plan whereby a better feeling between masters and men could be brought about, was most desirable. No doubt the labourer ought to have some share in the results of his toil, and in the value he produced. His (Mr. Botley's) experience was rather different from that of most people. They rarely had any trouble with the men at Hastings; but he could not say that formerly there had been very efficient working. They went on about the same lines until the agitation arose for eight hours' work, and for a rise in the price of labour. The good wages paid by the South Metropolitan Company, and the generosity with which they had treated their workpeople, soon extended their influence towards the South; and he found that unless some steps were at once taken to meet it, there might be trouble. He therefore took the matter in hand before there was a possibility of any difficulty, and consulted the foreman and the men with regard to their desires, to see if any arrangement could be made whereby they could mutually benefit. The first thing they took up was the eight-hour question; and he put it to the men that, if they insisted upon it, he might give it to them. There would, however, be a certain quantity of work to be done; and he could not see that it would be any advantage to them to have the eight-hour shift. Their works were of moderate size, making about 325 million cubic feet of gas per annum—very different from big works like Mr. Livesey's, where there was a large staff of men. He therefore suggested to some of the old stokers, who were quite efficient for doing the work in twelve hours, that, if they had to do it in eight hours, it would no longer be possible for them to perform it, and that it would always be necessary to secure a body of very stalwart, and certainly not old, men. Upon full consideration, they saw the force of the argument; and this was given up. The next thing was to grant them an increase of wages, so as to make the work effective. They therefore considered what would be a fair quantity of work for a man to do; and they adopted a scale under which each man would make a certain quantity of gas. The firemen being reckoned in, each man was to make 27,500 cubic feet of gas per day; and anything beyond this was to be paid for at the rate of 2d. per 1000 cubic feet. In the South, carbonizing would cost about 3d. per 1000 cubic feet. Since then the men worked very well. In many weeks they gained a bonus; and their wages made an average of about £2 a week. They had worked most satisfactorily; and the arrangement was advantageous both to the Company and to the men. If they had in the gang a man who was not efficient, they soon made him efficient, for the simple reason that they all suffered if he neglected his work; and, of course, if there were two or three bad men they all felt it. The question Mr. Livesey had raised was a very wide one with respect to profit-sharing as applied by the South Metropolitan Company. With regard to providing for the men in the future, there was the difficulty that a great many stokers were discharged in the summer; and the thing was to make an arrangement whereby these men could be secured on the books. He had brought the question before his Directors; but they preferred that the work should be self-supporting. What he did, therefore, was done entirely from the managerial point of view. They had a superannuation fund which was self-supporting—the men paying a certain amount each week; and they had thus been able to provide for many old men. His Board had now promised that, if he met with any difficulty in carrying it out, they would help him; so that the fund was in a better position. They had also a burial fund. By these means, they had secured at Hastings perfect harmony, good fellowship, good work, and mutual advantage.

The PRESIDENT asked Mr. Botley to explain the working of the superannuation fund.

Mr. BOTLEY said the men paid 4d. a week, and were entitled to 12s. a week on reaching a certain age—he thought it was 55. They were not entitled to it unless they were incapacitated for work. Of course, it was to their advantage to remain at work as long as possible; but if they met with an accident before, or were otherwise incapacitated at that age, they had a right to retire. They were only entitled to the benefits after ten years' service; but they arranged to take over all the men, without restriction, to begin with.

Mr. EASTWOOD said all their workmen received a pension when they were no longer fit for work. This, however, was a voluntary action on the part of the Board. There were no regulations about it; but if a man behaved properly while he was in their service, when he was no longer fit for work, he received a pension varying from 7s. 6d. to 10s. a week.

Mr. G. C. TREWBY said they were all much indebted to Mr. Livesey for having brought this subject before the meeting. They knew that his object was to benefit the men as well as to add to the prosperity of the Company over which he presided; but he (Mr. Trewby) could not help thinking the system of profit-sharing was very much like sloping retorts—they required more experience with regard to it. There were one or two matters relating to the details to which he should like to ask Mr. Livesey to refer in his reply. There was a large amount of piece-work done about a gas-works; and he could not see how the way in which the men so paid did their work was likely to influence the prosperity of a company. With regard to unloading coal, in most works this was done at a certain price per ton. In what way could this portion of the work influence the earnings of a company? In many of the works, the men were paid a very excessive rate of wages; and to add a system of profit-sharing to something like 15s. a day, which some of them received, would, to his mind, be going very much beyond the mark. Then take the case of the yard labourers, he did not see in what way they could affect the prosperity of a gas company. It was the same now as it was years ago—either the profit or the loss of a company was made in the retort-house. He could quite understand that the retort-setters were men who ought to be considered, because it depended in a great measure on how the retorts were set in the first instance from the design, and then how the work was carried out, what sort of results were obtained; and they were men who might very well be put on a proper system of profit-sharing. There was no doubt that a great deal of the prosperity of a gas company depended upon the stokers. If the men were on an ascending scale, he could quite see that it would be a very good thing, and there would be no difficulty about it; but Mr. Livesey had now arrived at the point when, as he had shown in his paper, the bonus had gone down from 5 to 2 per cent. Were the men satisfied with this reduction? If he were a stoker, and found, after slaving at the hot work of the retort-house, that the next six months his bonus went down from 5 to 2 per cent., and that men doing other classes of work were receiving a higher rate of wages, or aspiring to it, such as the coal miners—and, of course, dear coal would make dear gas—as he had said, if the stoker found that while coal-miners might be adding 10, 20, or even 30 per cent. to their rate of wages, he, who had to manipulate the coal, had to receive less in the shape of bonus, this would be a condition of things which would require a very peculiar mind to be reconciled to. Mr. Botley had told them about some scheme by which a man could get a certain bonus according to the quantity of gas

yielded per ton of coal or per mouthpiece. This was a very old plan. They started at quite a low rate. Their men had it for a number of years; and when, for some reason or other, they did not get it, they rebelled, and always looked upon it as part and parcel of their wages. If a rate per ton or per mouthpiece were fixed for any description of coal, and if, for any reason, a manager was unable to get this particular coal, and was obliged to use an inferior article, the stokers would turn round and say: "It is not our fault; if you only managed your business properly, or got us the kind of coal we want, we should be able to give you satisfactory results." He did not see how a system of this sort was to hold good for any length of time. Something had been said about the burial fund. This reminded him of what occurred at the Beckton works at the time when Mr. Livesey was in trouble. The foreman there took a great interest in the men, and instituted a burial fund, of which they were trustees, and which had been going on for two or three years in a satisfactory manner, there being a sum of £100 or more in hand. Then the men, having joined the Union, felt it would be a good thing if they could get this money out, and pay it into the hands of the Union officials; and they worried him about it, and requested that the money should be handed over to them. Of course, he could take no notice of the request; he told the men they must proceed in a legal manner. If by any means managers could bind the men to them, it would, no doubt, be very satisfactory; but one could not help seeing the evil effects of the Union, more especially in this case. Here was a sum of money collected and put on one side for two or three years for a special object; but the men, on the spur of the moment, thought they were going to have a great rise in wages, and that, if they could only get this money as sinews of war, it would be far better spent than in burying their fellow-workmen.

Mr. Botley explained that they laid down a standard of the quantity of coal to be carbonized, and of gas to be made, per man. If the men failed to do this, they were not paid; and very often they did not do it. Lately they, like other people, had had a difficulty with their coal, and had to use all sorts; but they did not find any trouble with the men. They knew they could not demand the payment as a right. It was particularly stipulated that their wages were to be a certain amount for making a definite quantity of gas; and if they produced more than this, they were paid in proportion. Many times they did not make the specified quantity because the retorts had been left off, and so on. The coal was weighed out to the men daily, and a balance struck every week.

Mr. Methven asked if the stokers were responsible for the fires.

Mr. Botley said there were separate firemen; but they were included with the stokers.

Mr. Frank Livesey said no doubt some day Mr. Botley would discover a method of making more than the stipulated 27,500 cubic feet per man per day; and then there would be the same difficulty as had been found when they paid the men a given sum per mouthpiece. When a certain standard was fixed, it was found, after a few years, that it was quite insufficient, and that the men could make considerably more gas. They always obtained the bonus; and consequently the standard had to be raised, which was very objectionable to the men. Some day Mr. Botley would easily make 30,000 cubic feet per man.

Mr. Botley: I should then alter the rule.

Mr. Livesey (continuing) said he could bear testimony to the benefit of the profit-sharing arrangement to this extent—that it was a work of education. The men—the labourers and everybody else—would in time take an intelligent interest in the company's business; and if a man not only brought his powers as a labourer, but also his intelligence, into his work, it would have a great effect in the end. He could not answer Mr. Trewby's question directly, by saying what interest a labourer, or a man who unloaded coal at a certain rate per ton, had in the general work, though the labourer certainly could do something. He did not see his way out of the difficulty of the men who were always working on piece-work; although, no doubt, there were means of interesting them in the scheme. A great many good propositions had been brought forward; and they had been adopted. Mechanics, retort-setters, and fitters had made suggestions which had been very useful; and probably they would not have been offered unless the men had felt they had some interest in making them. The workman should be paid fair wages to start with; and any profit shared with him should be in addition thereto. One could buy a man's labour, but not his intelligence. This must be the work of education; and, of course, it would take time.

Mr. H. Iago (Fulham) remarked that Mr. Botley had raised a question which was interesting, in so far as it gave an alternative to Mr. Livesey's plan. He (Mr. Botley) rather suggested that a form of pension or superannuation should be introduced, instead of the profit-sharing system. Mr. Livesey's own figures showed, he thought, a certain weakness in his system, inasmuch as the South Metropolitan men withdrew so large a portion of their savings. They worked more economically, and put more heart into their labour. But this was done at the expenditure of their energy; and the chances were that these men would wear out more quickly than those who saved themselves at the Company's expense. What could be done with men when they were worn out prematurely, as many of them would be, who had withdrawn their savings? They would be placed in this position—that a large number of men would be very inadequately provided for, although they had been paid quite sufficient to enable them, if prudent, to provide for their old age. The system of superannuation which Mr. Botley had introduced, was a very generous one; but he (Mr. Iago) thought he would have to call upon his Directors to help him out of his difficulties, for he did not see how he was to pay his way. Some system which would give to the men a superannuation allowance instead of this bonus money, which went almost as soon as it came in, would probably be the best solution of the difficulty.

Mr. T. May (Richmond) said he thought no one but Mr. George Livesey could speak from experience with regard to profit-sharing in gas-works; but he (Mr. May) felt rather inclined to criticize the principles on which the scheme was founded. It seemed to him that to make the selling price of gas the basis of the arrangement was wrong. The men could not practically influence this, except to a very small degree. The prices of coal and residual products were the two chief items which now affected the price of gas; and it seemed to him that it would be hard if, after the men had been working at their best during twelve months to bring about ½d. or 1d. per 1000 cubic feet reduction in the price of gas, it went up 3d., 4d., or even 6d., because the price of coal had advanced in the market from (say) 6s. 6d. to 13s. If a scheme of profit-sharing were introduced, he thought it should be made on estimates of the working expenses, which would be something the men could control by intelligent labour. He could understand that, in the case of the South Metropolitan Company, this was not applicable at the time the scheme was brought forward because the Company were in a difficult position. They had to meet the moves of the Gas Workers' Union; and probably something different was then necessary. Mr. Livesey gave the men a "nest-egg;" and this, no doubt, had a great deal to do with the success of the scheme. But in ordinary cases, he did not advise this; nor did it seem reasonable. If a scheme could be introduced on the basis he had suggested—viz., of working expenses, or the cost per 1000 cubic feet of gas manufactured—something might be done; but he did not consider that it could be satisfactorily carried out on the selling price of gas, over which the workman had practically very little influence. With regard to yard labourers, mechanics, and others, he thought they should certainly participate in any profit-sharing scheme. Anyone who had direct control of men would know that one man fully earned his wages, while another did not one-half earn them. Some men were persistent talkers and idlers, who might do better if they had some interest in their work; and therefore one and all should, in his opinion, be included in any scheme of profit-sharing.

Mr. C. C. Carpenter (Vauxhall) thought some of the members were rather going away from the point of the paper, which was profit-sharing. This was quite independent of the two-shift or the three-shift system. The scheme had been designed with the view of winning the sympathy, good-will, and energy of the workmen. Whether there were two shifts or three, managers were equally liable to strikes and disagreements. Mr. Eastwood had been very fortunate in keeping clear of labour-troubles; but he (Mr. Carpenter) did not think it was because he

had three shifts. In other places where they had three—as in Bristol, for instance, and other towns farther North—there had been a considerable amount of difficulty. With regard to the profit-sharing scheme itself, a question had been asked as to what way could the workmen do anything to promote the interest of their company, and why were they entitled to share in the profits it might make? There was a very good example of this in their own works. They were working with what they called the old hands, on the eight-hour system, from the time when it was initiated, in June, until the December of 1889. The men during that period kept splendid time, because they felt that, if any cause were given, the Company would in all probability weed out the troublesome ones; and scarcely a man out of the whole three shifts absented himself from work. But in spite of that, the work was never done well; and they could not keep up the yield of gas per ton of coal to the normal quantity they obtained before the eight-hour shift started. This was an instance of how work could be done by men who kept very good time, and on the three-shift system. Now, this system was still in operation at Vauxhall. The men kept equally good time; the only difference was they had their heart and soul in their work. There was a considerable difference, however, between the make of gas per ton then and now. Whereas before the strike they had the greatest difficulty in keeping it up, now it was unnecessary to do anything in the way of maintaining the carbonizing standard. The men made, without the least difficulty in the world, the full quantity of gas they could get from the common coal used in London. This was a very important factor. If one could secure good-will, he would get thereby his value for any money spent in profit-sharing. It had been objected that the scheme ought never to have been based on any standard the effects of which would be variable; but that, if it was desired to give a workman a bonus, it should be fixed at 5 per cent. and be given under all conditions. But this was clearly wrong. If, owing to any outside conditions, the Company were not able to work so successfully at one time as another, the disadvantage should fall equally on the workmen (*provided it did not interfere with the normal standard of wages*), the shareholders, and the consumers. If the men became accustomed to a normal bonus of (say) 5 per cent., there would be no reason for putting their shoulders to the wheel in times of trouble; but if the bonuses were made to depend on the price of gas, the men would know that, when this was rising, they were going to suffer, and they would use far greater exertions than they otherwise would to save and to prevent waste. He had found it so in a great many ways. Any practical man going round the works could see at once, not only in the case of retort-setters, but, to take the case mentioned by Mr. Trewby, labourers and coal men as well, whether they were doing their best. In the time between the granting of the eight-hour shift and the strike, they had considerable difficulty in this way. The men did not take care of the tools—indeed, they seemed to try to break as many as they could. This applied not only to the stokers, but to the men unloading. They knocked things about, and did not care what they did with anything. Now a pleasant feeling existed; and there was nothing of this sort happening. Even a man working piece-work all the year round, in the most monotonous task of filling in coal, could do something to earn his bonus. Mr. May referred to the "nest-egg" as being the cause of the success of the scheme. But this was only given to the old hands; and the new hands (of whom there was a large proportion) were at least as keen as the old ones with respect to the profit-sharing arrangement.

Mr. W. Foulis (Glasgow) said he could not altogether agree with Mr. Livesey's method of fixing the bonus by the price of gas. There were a great many circumstances which might affect this, over which the men really had no control. The price of coal, residuals, and many other things made it exceedingly difficult to fix a bonus upon such a basis. They had heard a great deal about the effect of the bonus on the work done; but probably this arose not so much from the fact that the men were to be paid on the profit earned, as that there was hearty good-will between the workmen and the foremen and managers. In such a case, the work was much better done than when the men's feelings were not altogether so friendly. It would be difficult to adopt any such system as that suggested in the case of corporations, because they did not always reduce the price of gas when they made a profit. In Glasgow, it had known that in some years they had written off capital £60,000 or £70,000, which might have gone to reduce the price of gas. This was all profit; and the workmen would have just cause of complaint in a case of this kind. About two years ago, he thought it desirable to try to introduce a method of getting the men to take more interest in their work; and he inaugurated the system of allowing, as a favour, men who were recommended by their foreman as being good steady men, to enter into agreements for any time they pleased—three, four, or six months. The condition was that, if they served the term of their agreement satisfactorily, and did their work well, they would receive at the end of that time a bonus equivalent to a shilling a week. This system had worked so satisfactorily, that the difficulty had not been to get men to sign the agreements, but to prevent any but the very best men obtaining the advantages it offered. The consequence was this, that since the system had been introduced, they had had better and steadier men, more willing workmen, and altogether a much pleasanter state of things. The men who had not been allowed to sign stuck to their work well, so that they might be recommended by their foreman. This system did not go the length of Mr. Livesey's; but it had the effect of producing a great deal of good-will which might not otherwise have existed.

Mr. T. S. Lacey (Pimlico) wished to draw attention to what was probably the real reason why they did not have so much trouble in Liverpool as in London. The men there had the material weighed out to them; and, whether dissatisfied or not, there was never any doubt about their doing the work for which they were paid. In London the system had been nominally piece-work, though actually day-work. The men had been accustomed to putting in a certain quantity of coal with astonishing exactness, considering that it was never weighed out; and when there was no endeavour to shirk the work, the amount put in was as regular as if it were really weighed. When, however, the agitations commenced, the agitators tried to hammer it into the heads of the men that work was a thing to be avoided as much as possible, and that their duty to their fellow-workmen was to increase the amount of work to be done, so as to bring other men in, and to do individually as little as was possible. The result of this was that, although the men were being paid for a certain weight of coal, they did not put it in the retorts. In any system by which men were paid on the bulk of coal carbonized, or the quantity of gas made, it was absolutely necessary that they should do a certain definite amount of work per man.

Mr. J. Methven (Beckton) desired to allude to one or two methods of so-called profit-sharing in a somewhat different direction from that indicated by the author of the paper. He referred particularly to Mr. Eastwood's and Mr. Botley's suggestions. It seemed to him, however, that the conditions mentioned by these gentlemen must be dependent upon the locality. What would suit one company could not possibly suit another. At Liverpool the stokers were responsible for maintaining the heat of their fires, putting in the coal, and taking out the coke. In fact, each man had his share in the whole labour of the carbonizing work; and he could understand then that a man might be induced to devote more time and attention to routine. In Mr. Botley's experience, the fires were attended to by different men, although they formed themselves into a gang, and were included in the benefit derived from the extra quantity of gas made. It seemed to him that the suggestions of Mr. Eastwood and Mr. Botley might be more suitable for bringing the stokers within the reach of a profit-sharing arrangement. With regard to the question of the quality of the coal dealt with, it struck him that this difficulty might be avoided if they confined themselves to the quantity of gas made. The quality of coal varied; and in order to bring the gas up to the proper standard of illuminating power, there would be required a certain percentage of cannel, which was quite independent of the work done by the men.

Mr. Denny Lane (Cork) said he would merely give the result of some experience they had had in Cork, in which they had adopted a method somewhat similar to that mentioned by a previous speaker. Several years ago they had a good deal of trouble with their men, who struck immediately after Christmas. Fortunately, they were able to get in others to do the work. They prosecuted those who left without notice, and succeeded in getting convictions

against them, and especially the ringleaders, who had a tolerably smart term of imprisonment. After this the principle adopted was to pay, not per 1000 cubic feet of gas made, but per ton of coal carbonized. They found it more economical not to produce a large quantity of gas per ton of coal, because they supplied it of good quality—far beyond the standard; and it was better to reduce the production, and so avoid to a great extent the use of cannel, which was very expensive in Cork, owing to the initial cost, and the very small quantity of the residuals obtained. They therefore agreed to give the men a certain sum per ton; and they subsequently made a further advance when they saw labour troubles impending. At the time of the general agitation, the Directors voluntarily added 2d. per ton to the price. Besides this each man was entitled, if he remained with the Company until the end of the season, or until such time as he was permitted to leave by the Resident Engineer, to a premium (once a year, and sometimes twice) of 2d. per ton. Since this system had been introduced, they had not had any trouble. On one occasion, a workman sued the Company for the amount of bonus; but when it was explained that it was given only as a premium, and that he had left without permission, the Court decided against him. So far, so good. But, on the other hand, the disadvantage of the system was that it gave the men a great temptation to overcharge the retorts; and the result was that, although they did not seek for a high production of gas per ton, they obtained less than they should. At some parts of the setting, the retorts might not be so hot as they should be; but the unfortunate thing was the men tried to put as much coal in them as in those which were better heated. The result was that they were at present considering whether they could not adopt a better system. He could not agree at all with the principle Mr. Livesey had put forward, that the wages of the stokers should be dependent on the general profits of the concern. Supposing there happened to be a dishonest secretary who robbed the company, or a corrupt board of directors who paid more for coal than they ought to do, or some great agitation occurred in the town, which forced a company to reduce the price of gas, either by threats of electric lighting or something else—were any of these facts anything for which the stokers could in any way be liable? Some system of paying on the number of tons of coal carbonized, and the quantity of gas produced, would, he thought, be best. In many instances, different kinds of coal had to be used; and in such cases there ought to be a fair allowance made to the men if material less productive than that ordinarily used had to be employed.

Mr. S. Glover (St. Helens) said he thought corporations should not be entirely overlooked in this matter; and therefore he should like the President or Mr. Livesey (as the "father" of the profit-sharing scheme) to give them some idea of how he would adapt to corporations this method of payment by result or profit. As Mr. Foulis had pointed out, in a corporation the thing depended on a great many considerations which did not come in, in the case of private companies.

Mr. G. Livesey, in reply, said he would try to summarize the criticisms which had been passed on the paper, and which were not so numerous as he had hoped they would be, because it was through criticism that improvement was made. Mr. Iago thought it was a weak point in the scheme that the men had drawn so much money. It had astonished him (Mr. Livesey) that they withdrew so little; for, out of the total amount which was credited to them on the books, and which they were perfectly free to take on giving a week's notice, they left half with the Company. This showed that half the men, at any rate, were thrifty, which was a larger proportion than he expected to find. The principal criticisms which had been urged by Mr. May, Mr. Denny Lane, Mr. Trewby, and one or two others, had reference to the fact that the workmen could not influence many of the most potent causes of an increase or a reduction in the price of gas. Neither could the shareholders, nor the managers, nor anybody else. How could they influence the price of coal? Yet they benefited or suffered as coal rose or fell. Their dividends or salaries were regulated in that way. At any rate, the shareholders' profit depended on many circumstances over which nobody had any control; and he therefore saw no reason why the workman should not have his share in the adversity or prosperity of the company.

Mr. Foulis remarked that managers would not like to be paid in that way. He should certainly object to having his salary reduced according to the price of coal.

Mr. Livesey said probably Mr. Foulis did suffer from this cause. At any rate, managers felt it; for in prosperous times they had an increase of pay, and in hard times they did not, though they often had to do a great deal more work. But profit-sharing was something over and above the normal pay of the employees. Probably the footing on which they stood was more like that of the shareholders, who participated in the general benefit and prosperity of the company; and he maintained that the employees ought to participate in the same way. Mr. Denny Lane and Mr. May had said that the men could not influence prices. This was quite true; but they might do a great deal in other ways, as Mr. Carpenter had pointed out, to forward the prosperity of the business. In fact, the cheerful workman was worth 5 per cent. more than the listless one—

> "The merry heart goes all the day;
> The sad one tires in a mile, O;"

and the fact of having a cheerful workman compared with such as they had at his works before the strike, was equal to a considerable sum per ton of coal. Mr. Denny Lane made some strong observations about the dishonest secretary, the corrupt directors, and the electric light. But somebody must suffer from these things; and he (Mr. Livesey) did not see why the workmen should not bear their share as well as everybody else. What he wanted to see was that workmen should be treated as partners, and have a direct interest in the prosperity of the concern. If things went badly, if coals rose in price, what did managers, directors, and others do? They tried to counteract the adverse influences by doing what they could in other directions to improve their profits. As to the yard labourers, he quite agreed with Mr. Trewby. He could not point to anything direct; but he was sure of this, as was so well put by Mr. Grey—though perhaps farm labourers were rather different—that a yard labourer who would do his duty conscientiously and honestly, without being watched all day, and took an interest in his work, was worth far more than a man who was determined to do as little as possible, and therefore required constant supervision by the foreman. If a yard labourer felt that when he did an honest, fair day's work, the profits of the company with which he was connected would be increased, and he would get a larger bonus, it acted on him in that way. As to the coal fillers, perhaps they could not do very much; but at any rate, as Mr. Carpenter had pointed out, they could avoid breaking the tools and wasting coal. The plan the South Metropolitan Company had adopted with a good deal of their piece-work was to give it to the men in rotation—not to let any set of men have the whole. As to the plans recommended in place of profit-sharing, he could not agree with them, because they did not go far enough—they were mere palliatives. Mr. Botley and others had spoken about piece-work. He (Mr. Livesey) quite agreed that if a system could be introduced whereby stokers should be paid something extra, in proportion to the value of the work they did, it would be a good thing. But he had been puzzling his brains in vain for twenty or thirty years to find out a system which would work satisfactorily. Mr. Denny Lane paid his men an extra 2d. a ton, which secured them from striking; but they crammed the coals into the retorts, whether they carbonized them or not. He thought Mr. Botley would find in his plan difficulties which far exceeded those which appertained to the very simple system of profit-sharing. As to the question of pensions, he held that, in connection with such a concern as a gas-works, whether it belonged to a corporation or a company, they ought to make provision for their workmen, by calling upon them to appropriate a certain sum per week towards a sick and superannuation fund—the employers contributing a definite amount also, and providing for the men in sickness and old age. But this was a different thing from profit-sharing. They had at the South Metropolitan works a sick fund which was started by his father in 1842; and he also initiated a superannuation fund in 1855. These had been in operation for a long time; but they had not the slightest effect in inducing the men to take more interest in their work, and do it in a more energetic manner. He wanted the men to feel that the prosperity of the concern depended to a considerable extent on the intelligence and energy they might put into it. Mr. Glover had asked whether something of this kind could not be applied to a corporation

He (Mr. Livesey) saw no reason at all why it should not be. Of course, there were difficulties in the way. It might be adapted to the circumstances of one case, but these would not apply without modification in another; and the case of a corporation was not quite parallel to that of a company. With regard to what Mr. Foulis had said, the amounts written off capital, or carried to an improvement rate, were profits to all intents and purposes. If, therefore, a corporation adopted a system of profit-sharing, and if that share was calculated on the price of gas, the workmen would have ground to complain if the price was not reduced. They would have them on the same side as the consumers. But it was impossible off-hand to set out any system of profit-sharing, without knowing all the facts and circumstances of the case. He had, however, no doubt whatever that it could be applied to corporations, and also to companies not under the sliding scale, if there was a will. The difficulty was to move directors and town committees. He was sorry to say that directors, as a rule, were very difficult to move when things were going smoothly, *which was the right time for action;* and probably gas committees were equally difficult to convince. But that something of the sort was necessary, he had no doubt whatever; and it should be done at once if good relations were to be obtained and maintained. Mr. May said it would be better to base profit-sharing on the working expenses; and some seemed to think it should be confined mainly to the stokers. It would be found very difficult to base any system on working expenses. There was nothing like simplicity; and the moment one began to deal with these questions on the basis of working expenses, endless difficulties and complications would be encountered. The system now adopted seemed to be understandable by the men. He did not say they thoroughly understood it, or that all the men, or even a large majority of them, quite appreciated the system. But a considerable number were responding in the spirit he had hoped; for the movement was educative, and so far it had been a great success. As to the men accepting a reduction from 5 to 2 per cent., so far as he could see, they understood the position, and accepted it cheerfully. He asked them, before the price of gas was altered, what they would say in such an event; and the reply was: "Oh, we shall be very sorry; but we shall try to get it back again as soon as possible." Mr. Foulis said he had the good-will of the men with his agreements and shilling a week bonus. No doubt this was so; but he had not their interest. The shilling a week he gave them, obtained their goodwill; but the prosperity of the concern did not come into it at all. If the Glasgow Corporation had a very bad or a very good half year, it did not matter to the men. They had their bonus at the end of the term, whether the concern was prosperous or not. If they were going to give a bonus of a shilling a week—this was getting on to 5 per cent.—why not try to obtain all the good they could out of it? He quite approved of Mr. Foulis's plan, so far as it went; but it did not go far enough.

The PRESIDENT said it seemed to him that Mr. Livesey had made out a very good case for profit-sharing. All other schemes which had been mentioned appeared to be only partial in their effect; and they were not entirely satisfactory, even to those who were trying them. On the other hand, the scheme before them, which had now been in operation for a considerable time, was, as Mr. Frank Livesey so well put it, an education all round. It touched every department of the work, and seemed to bind all together in one common interest. They were greatly indebted to Mr. Livesey for bringing the subject so admirably before the meeting; and he had great pleasure in moving a hearty vote of thanks to him.

This was accorded by acclamation.

The Papers by Messrs. Browne, Lewes, Lacey, and Pryce, on Oil Gas Manufacture, Etc.

The PRESIDENT said the question of using oil to replace cannel was one of the foremost of the time; and he hoped it would be thoroughly discussed.

Professor FOSTER said he had not had time to read the papers; and having heard but a part of them, he was not prepared to say much upon the subject. One point struck him in the President's address as being important. Mr. Hunt had arrived at some conclusion as to the right use of oil when employed for enriching purposes, and distilled in the usual way—viz., that it was more economical to distil it in a separate retort, and make a specially rich gas, than to mix the oil with the coal in the ordinary retort. It seemed to him (Professor Foster) that this was a very important question. It ought to be settled at once whether the oil should be distilled along with the coal, so as to have a mixed product (if it might be so called, though he did not know that it was really mixed), or to distil it alone. In making carburetted gas from oil and water gas, the course was perfectly plain. But enriching coal gas was a different question; and they ought to settle in their own minds whether to make a rich gas, and put it into the purified coal gas, or mix the oil with the coal. He had rather a strong opinion on the matter; but, as it was only derived from laboratory experiments, he did not like to urge it at present.

The PRESIDENT said he had perhaps better put Professor Foster right with regard to what he had said in his address. He really showed, by experiments, that mixing the oil with the coal produced a more economical result than making oil gas. He did not advocate this plan of using the oil; but certainly the result showed that whereas, making oil gas, the cost of enriching was 0·86d. upwards per candle unit, by mixing oil with the coal, and carbonizing in the ordinary way, enrichment could be obtained at a cost of only ½d. per candle unit. He suggested that the reason for this might be that the gases being evolved from coal at a somewhat lower temperature than the surface of the retort, might protect the oil gas from being decomposed. He did not know if he was right; but Professor Lewes apparently confirmed this view by his suggestion of the economy of "cracking" the oils in the presence of nascent gases; though whether this was quite the same idea, he must leave the scientific gentlemen to decide.

Professor FOSTER said the questions should be kept perfectly distinct. To make gas from oil and water gas was one thing. There one had a definite object—quantity and economy being prime considerations—and one could direct the plant, and work it in a certain way. But where the use of oil was small relatively to the coal employed, it did seem to be a question yet to be decided whether it was more economical to do this by a separate arrangement, so that one could specifically put in what was required for enriching purposes, and no more, or to mix the oil with the coal. Gas shareholders kept a watchful eye on the profits made in this industry.

Mr. FOULIS said he did not know exactly how the experiments referred to by Mr. Hunt were made; but the system of mixing oil with coal, was that adopted in what was called M'Kenzie's processs of manufacturing gas. He must say that the experiments Mr. Hunt was making would need to be continued very much longer before they would influence his mind as to the practicability of carrying out such a system. At all events, he firmly believed that much more certain results would be obtained by making the oil gas separately, and mixing it with coal gas, also made separately; and he believed, on the whole, it would be found more economical. There could be no doubt, he thought, as Professor Lewes had said, that when oil was cracked in the presence of some gas the results were better. It was found, by experiments made in Glasgow, that very much better results were obtained when the oil was sprayed into the retort by a jet of steam. Of course, in every case, the oil was carried in a pipe to the very back of the retort, so that the whole of the oil was vaporized before it came in contact with the hot surfaces. The papers were all exceedingly interesting—bringing the subject nearer to a practical solution than it had yet been; but it did seem to him that two things were very important. In the first place, it was highly necessary to secure an abundance of shale oil at a cheap price, as unless this could be done, their labours were largely in vain: Secondly, unless it was found more profitable to go into the manufacture of water gas, and enrich it, whatever method was adopted for producing oil gas, it was important that it should, as far as possible, be available for manufacturing either coal gas or oil gas. In other words, it would be a great advantage if the ordinary retorts could be used without having a special form. He found clay retorts gave equally good results with iron, if the oil was first vaporized in an iron tube running through them.

Mr. DENNY LANE said there seemed to be some slight discrepancy between the experience of Mr. Foulis and that of Mr. Browne in this respect. The latter gentleman said there was considerable loss of oil by leakage through a

clay retort. But possibly if the retort had previously been used for the distillation of coal, the pores would have become stopped up, and have prevented the escape. It might be possible to have a receiver, like a skip, in front of the retort, to contain the oil until it became vaporized, which would possibly prevent the escape of oil in vapour. In Pintsch's process, they put in a clean iron tray, on which to run the oil, though the retorts were made of iron.

The PRESIDENT remarked that Mr. Foulis was referring to the experiment of injecting oil together with steam into the retort.

Mr. J. METHVEN said he had made some experiments on this subject; and they had convinced him that it was absolutely necessary, in order to obtain an economical result, to have proper conveyors for these oils when cracked up. His earliest experiments were made by mixing oils of different character with coal in an experimental retort; and he was very much disappointed with the low result in illuminating power which he then obtained. Repeated experiments eventually convinced him that there was some mischievous operation going on in the hydraulic main—that one of the hydrocarbons (possibly a heavier one) laid hold of the lighter ones which came off from the oil, and consequently absorbed the light-giving properties of the mixture. He extended his experiment, with the view to forming a conveyor or carrier of these hydrocarbons, which were cracked up in the retort. The oil was injected into the retort by means of steam pressure; and, to make it more effectual, he superheated the steam. Oil gas and coal gas were made alternately in this apparatus, and were mixed in the holder after purification. These experiments gave him better results than the first series; but still they were unsatisfactory—some of the hydrocarbons or light-giving material being lost. The next series of experiments consisted in passing purified coal gas into the ascension-pipe of the retort in which the oil was being carbonized or cracked up; and these gave much the best result. At the first start they put the purified gas into the retort itself. But they found a decided loss took place from the action of the heated iron retort on the gas; and they concluded at once it would never pay. Eventually they placed the connection conveying a measured quantity of coal gas of known illuminating power in the ascension-pipe, where it met the vapours coming from the oil; and the experimental results were exceedingly satisfactory. They were erecting an apparatus at Beckton to make it on a large scale; and he hoped it would have been ready, so that he would have had the figures to lay before the present meeting. But on some future occasion he hoped to be able to do so. He could not help thinking that this was the direction in which they must look for the economical use of oil as an enricher. There must be a conveyor for it. If they cracked it up and put it with the gas in the hydraulic main, the heavy hydrocarbons in the uncondensed gas—the tar, and so forth—would absorb the light-giving constituents of the oil, and a great portion would be wasted; but by providing at once a suitable conveyor, freed from deleterious hydrocarbons, a permanent gas could be made with very economical results.

Mr. W. W. FIDDES (Bristol) said it appeared to him that the question resolved itself into this—that they must crack up these oils separately, that it must not be a simultaneous process with the making of coal gas, for this reason: The President had just mentioned that it was absolutely necessary that none of the tar oil should get in with the ordinary tar, and that wherever the contact of the two gases came in the process of manufacture, one tar would eventually deteriorate the other. Again, it seemed that, with regard to the tar oil, they did not know at present that it was not a much more valuable product than tar from coal gas; and it appeared to him that the first thing to ascertain was the relative value of these, and whether the spoiling of the coal tar would not prevent its being used in the retort with coals, as had been mentioned by several speakers.

Mr. GLOVER said he was disappointed with the Rotherhithe experiments; and the salvation of the whole thing seemed to him to rest with Professor Lewes's paper, which to his mind was the most important contribution to their knowledge on the subject. For some time he had been looking for an apparatus which would provide gas makers with the means of quickly producing gas in large quantity and of high illuminating power. When there was so much talk of water gas being made at a very low price at the Leeds Forge (they had all heard of the Samson Fox arrangement at Leeds), he went over to look at it—not believing all that was said of it, but to learn how it was worked. There he was very much pleased to find what some would like to see—the holder rising before his eyes. Of course, it was a small holder in comparison with what most of those present used; but in proportion to the apparatus, the holder rose very quickly. There was also the production of a large quantity of gas of scarcely any illuminating or heating power. He should like to ask Professor Lewes whether he thought the production of water gas, the addition to it of some of the producer gas—the gas resulting from the heating up of the producer which made the water gas—and the further addition of illuminating power from oils, would furnish a solution of this difficulty. A solution was certainly being looked for throughout the country. He came from a county whence they had been sending to London large quantities of cannel. But the supply was becoming scarce; and they would soon have to provide themselves with illuminating power from other sources. Not long ago he was in a mine where there was once cannel to the thickness of 6 or 7 feet. But this was exhausted; and other mines were also nearly worked out. He had himself made some experiments in the direction of using oils and tar, and had watched the experiments with the so-called Dinsmore apparatus; and they confirmed the opinion of Professor Lewes, as well as that expressed by Mr. Methven, that this high-quality gas must be made in, or at once introduced into, the presence of a carrier. Whatever success had resulted from the Dinsmore process had been achieved when the tar had been decomposed in the presence of nascent or new-made gas. He had always fought shy of this process, on account of the presence of so much carbon and pitch, which could not be made into illuminating gas; and he should like to ask whether any of the oils recovered from the distillation of coal tar—for instance, the light oil used for syringing into exhausters to dissolve pitchy matter—might be helpful in this direction. It seemed to contain a large quantity of illuminating property in the presence of some carbon. Seeing that they were not going to have so large a revenue from tar in the future, if they could make use of the oils they formed themselves in enriching gas made quickly in the water-gas process, it would be of great benefit. One of the theories they were accustomed to hear about the mixture of gas of high illuminating power with other gas of low power, was being knocked on the head in practice. They used to be taught that to make a very rich gas and a very poor gas, and mix them, would not produce the best result. Possibly, if they wanted to make 19-candle gas, they might make 18-candle from coal and 20-candle from enriched water-gas, and mix the two together; and they would then be using up some of their coke in the producer.

Professor LEWES said gas managers had many heart-breaking jobs at the present time; but Heaven help the man who tried to enrich producer gas up to anything like illuminating gas. In making water gas, they had to deal with two combustible diluents—carbon monoxide and hydrogen; and it was the intensely poisonous property of the former which had given rise to several accidents at Leeds and other places, which was, of course, a great check to its introduction as a diluent. On the other hand, producer gas was simply a mixture of a small proportion of carbon monoxide and a large volume of inert nitrogen from the air; and inasmuch as even 2 per cent. of nitrogen brought down the illuminating properties of coal gas to a serious extent, he left it to anyone to judge what the 66 per cent. present in producer gas would do. He was afraid, therefore, that a mixture of producer gas and water gas would not be practicable. On the other hand, it was asked whether some of the lighter oils from tars could not be used for enrichment. If one could only produce from tars the lighter oils, rich in benzene, at a price which would compete with light gasoline and carburine, no doubt this would be at once effected; but even at present, looking at the deterioration in the price of light oils from coal tar, benzene, and so on, he did not suppose it could be bought in large quantities at less than 1s. 5d. per gallon, whereas light paraffin could be had at 8¾d. It was chiefly this which militated against it.

Mr. GLOVER said they sold their tar to a distillery, and bought the oil he had mentioned at 4d. a gallon. This question was forced on his mind by seeing about the streets large boilers containing paraffin, which was being

sold retail at the low price of 6d. per gallon. If it could be sold at this figure, men with distributing mains could gasify it, and deliver it more economically than they could do in its liquid state; and possibly paraffin sold at 6d. per gallon retail might be purchased by them at 4d.

Mr. C. C. CARPENTER said there were one or two points about which he should like a little information. Mr. Lacey gave the cost (from figures furnished by Mr. Wright, of Bromley) of raising the quality of common gas from 15½ to 16½ candles at 1·25 gallons of carburine per 10,000 cubic feet. Mr. Browne, in his paper, stated that to raise gas from 15 to 16 candles required 2·5 gallons of carburine. Mr. Browne probably used the "London" Argand burner in testing. It was therefore evident that one experimenter found it necessary to use double the quantity of carburine to do about the same amount of work. They all knew that doctors disagreed; but so great a discrepancy seemed to require explanation. There was another discrepancy of some importance. Mr. Lacey had given some information as to the augmentation in the volume of coal gas when enriched by means of carburine; and he said the increase was very small—about 0·3 per cent. But Mr. Browne quoted figures showing that one gallon of this petroleum spirit yielded 100 cubic feet of vapour, which was more than three times as much as Mr. Lacey found. Both of these points were very important, as bearing on the question of cost; because some of the advocates for using these light oils said one must not only take into consideration the great improvement in illuminating power, but also the considerable increase in volume of gas sold. He should like to ask Professor Lewes a question with reference to his experiment in passing coal gas through a heated porcelain tube packed with fragments of porcelain. He said that, when this was done, the gas became non-luminous; but when previously mixed with twice its volume of hydrogen, the amount of carbon deposited was only 1-200th of that found in the original experiment. The point not quite clear to his (Mr. Carpenter's) mind was this—that the quantity of hydrocarbon present in the gas was such a very small percentage of the total volume, while there was still a large percentage of hydrogen. He did not quite see how the difference in the two experiments was accounted for; but doubtless Professor Lewes would easily set him right. One small point deserving mention with reference to Mr. Lacey's paper was the ventilating of the oil-tanks. It seemed to him that, instead of ventilating these tanks by a pipe beside the gasholder column, it would be better to take the ventilating-pipe into the district main, and so get the benefit of the vapour in a useful way, instead of wasting it in the atmosphere.

Mr. C. E. BOTLEY said he had not much to add to what he said last year on the subject before the meeting; but one or two points had cropped up on which he might afford some information. He was glad to find that the experiments made by the several gentlemen on the value of various oils accorded very well with his own observations. The quantity he gave, on the average of a number of tests, carried on over a practical working of several years, was 75 cubic feet of 50-candle gas per gallon of oil. This was fairly in accordance with what had been stated. With regard to utilizing clay retorts, he tried them very assiduously for a long time, both vertical and horizontal; but he found there was no possibility of keeping them tight. He had tried them in the way Mr. Denny Lane had suggested, by charging them with small coal or tar; but they lasted only a very short time, as there seemed to be some power in the oil of penetrating the pores of the material. They were therefore finally abandoned. In the manufacture of oil gas, no doubt the time of contact was the most important factor; and also the heat that was necessary. One oil was totally different from another; and this knowledge could only be gained by experience. The system adopted by him was to send the oil into a long Ω-shaped retort, about 6 inches wide and 4 feet long. It was then passed out at the back of the lower retort into the upper one, and went away into the ascension-pipe. In this way he anticipated that, if any oil were not gasified in passing through the first retort, it would fall back, and undergo the process again. The mode of testing the oil gas was very important. In his own case, the principal object was to know the light that would be given in a railway carriage. He therefore took the burner adapted for lighting railway carriages, consuming 1 cubic foot per hour; and this was afterwards calculated out on the 5 feet per hour basis, and the correction made the same as for every other test. In Mr. Browne's paper, there was a remakable statement which did not accord with his own experience—viz., that he found no difference when the gas was passed through an oxide purifier. He (Mr. Botley) had tried this many times, and found a new oxide purifier depreciated the oil gas very considerably

Mr. C. GANDON (Sydenham) said he had recently had some experience of manufacturing gas from oil; and, therefore, might add something to the discussion, though he feared he should only add confusion. Mr. Carpenter complained that the papers did not agree in two cases; and his (Mr. Gandon's) experience would make a third divergence, as he had had some conflicting results himself, so that he was not surprised if others did not agree. The papers dealt with two modes of increasing the illuminating power of coal gas—one, by the destructive distillation of the oils; the other, by simply vaporizing them, and adding the vapours to the gas. He had tried both plans. Some twenty years or more ago, he tried various devices for the destructive distillation of petroleum oils, for the purpose of enriching wood gas, and he was successful to a certain extent; but he always experienced the difficulty of getting both a deposit of carbon in the retorts and stoppages in the ascension-pipes and connections. To some extent, this was overcome by working at a certain temperature. There seemed to be a particular point at which these disturbances were reduced to a minimum; but directly this was either exceeded or reduced, the difficulties began—either the pipes were stopped, or there was a large quantity of condensation. It might be said that, if the temperature required was known, it was easy enough to keep to it; but it was extremely difficult to keep any particular temperature constant. He had recently been trying the same thing—using crude Russian oil with an apparatus which professedly came from Russia. He did not think it differed much from what had been described. It consisted principally of an elbow retort; but what virtue there might be in this, he did not know. The idea probably was to combine the two retorts in one, instead of having separate ones as in the Pintsch system. With this apparatus they had obtained very variable results—ranging from 70 to nearly 136 cubic feet of gas from a gallon of oil, according to the heats, and the rate at which the oil was run in. He could not give the exact dimensions of the retorts; but they were about 9 inches in diameter, and from 4 to 5 feet long. The conclusion he came to was that, on an average, it was possible to obtain about 100 cubic feet of 40-candle gas per gallon of oil. They had no apparatus for actually testing the illuminating power—it was only done by a jet photometer; so that he could not give accurate figures. He found that, by mixing 3 per cent. of this oil gas with 97 per cent of coal gas, the illuminating power was increased by something like two candles. It was difficult to get at the cost; and the figure he had arrived at was more an estimate than anything. But the conclusion he came to was that it cost about ¾d. per candle per 1000 cubic feet. They had also been trying the Clark-Maxim carburetter, of which he could speak highly, as giving satisfactory results. So far as he could get at it, the cost to enrich gas by one candle was about 1¼d. per 1000 cubic feet. This did not seem to agree with the figures given in the papers; but he might say they had only been able, up to the present time, to make two experiments. At first he found that, to increase the illuminating power by half a candle, the cost was 0·96d per 1000 cubic feet. At the second trial, made only two days before the meeting, it cost about 1¼d. per candle per 1000 cubic feet. There was thus sufficient divergence in his own results to account for differences in those of other people. The increase in illuminating power seemed to be maintained at the distance of a mile from where the gas was made. A doubt had been expressed as to whether, the carburine being mixed with the gas in the shape of vapour only, the improvement would be maintained; but his experiments seemed to show that it was.

Dr. DVORKOVITCH said this question of enriching gas by means of oil was one of very great importance. He had made a considerable number of experiments at the Moscow University; and he found there was a very great difference in the results according to the size of the apparatus used for gasifying the oil. He put some figures on the black-board, showing the various results obtained from using a ¾-inch and a 1-inch pipe. With the ¾-inch

pipe he obtained 45 cubic feet of gas, which gave 37 per cent. of tar of a specific gravity ·930. In another experiment, with the same heat, but using the 1-inch pipe, he obtained 72 cubic feet of gas with 30 per cent. of tar, of the same specific gravity. The 37 per cent. of tar contained 25 per cent. of products distilling over at 80° to 140° Celsius, and 13 per cent. at 140° to 200°. After re-distilling, he obtained from these two together 20 per cent. of pure benzol. From the second experiment, with the 1-inch pipe, he obtained 24·7 per cent. of crude benzol, and 10·3 per cent. of crude toluol; and after re-distillation of these, he obtained only 18 per cent. of pure benzol. It was very important to ascertain how petroleum could be utilized for enriching purposes; and he was quite sure the only way in which this could be done economically would be by depending upon the residuals produced. The most important question, therefore, must be the tar; and if so large a percentage of pure benzol as he had stated could be obtained, this would go far to solve the problem of expense. The temperature employed to get the 37 per cent. of tar was a dark red; while in the second case, it was a bright red. The first was about 1350° Fahr.; and the other about 1500°. But the most important point was the size of the pipes. He had tried retorts, and found a bad result; so that it seemed necessary to use the smallest possible pipes for carbonizing the oil. This was probably because it was only possible to gasify oil by the surface, not in the centre of the retort, where there were only vapours which spoilt the tar, and gave the gas a low illuminating power.

Mr. A. Colson (Leicester) asked if he rightly understood that the suggestion was to first of all distil, at a low temperature, for the production of tar, and then to re-distil the tar for the production of benzol, which was to be utilized for the enrichment of gas.

The President said this was not so. As he understood, the benzol was far too valuable to use in that way. It would be sold as a bye-product; and it could be obtained from a cheap oil, which would not only yield this large quantity of valuable residuals, but could also be utilized for enriching gas.

Dr. Dvorkovitch said he had not ascertained the illuminating power of oil gas made from small pipe-retorts; but it would be very high.

Professor Lewes said the point seemed to him to be this—that, after making the oil gas, there was left the tar of such a value that it could be used as being the real object of the manufacture, still utilizing the gas which came off as a bye-product for enriching the coal gas.

Dr. Dvorkovitch again explained the difference between the two tars after re-distillation, as showing the alteration due to the use of a ¾-inch pipe and a 1-inch pipe. He had many other figures, having tried 1½-inch, 2-inch, and 3-inch pipes. So long as it was not possible to obtain valuable tar from petroleum, it would be impossible to enrich coal gas cheaply by it; but when valuable tar was so obtained, the petroleum might be introduced economically. He had worked a long time in Baku; and his impression was that, as soon as a large quantity of petroleum was used in England for enriching purposes, the price would rise from 3½d., as it was at present, to at least 5d. per gallon. So that it would not be prudent to calculate upon the price remaining always at the present low figure, as advocates of oil gas enrichment seemed disposed to do. In reply to Mr. Denny Lane, he said the length of the pipe employed was about 2 ft. 3 in.

Mr. Eastwood said he had listened with much pleasure to the papers and the discussion, because it would be a great advantage to gas managers if they could reduce the quantity of cannel they were now obliged to use. The papers resolved themselves into two—one, the means of making a very rich oil gas; and the other, a method of carburetting gas when made. Experience proved that a rich oil gas could be made which might be substituted for cannel; but he had never yet found any reference to the enriching of ordinary coal gas—say, from 16 up to 22½ candles. Mr. Lacey had referred to enriching it from 20 to 22½ candles. But he (Mr. Eastwood) did not find any allusion to enriching gas from the lower quality up to 22½ candles; and he should be glad to know if any experiments had been made to bring the illuminating power of ordinary coal gas up from 16 to 22½ candles. One matter which had a bearing on Mr. Methven's experiment in conveying gas into the ascension-pipe, was this: Wherever they were using rich shales, they were never able to get as good results if they put the shale along with the coal into the retort as they did when they put the shale into the retort by itself. They distilled the coal by itself, and the rich shales by themselves; mixing them in a hydraulic main free from heavy tar.

Mr. Trewby said he had not had time to read the papers; but he should like to make a remark on what Dr. Dvorkovitch had said with regard to the valuable tars from crude oil. It had been for some time a pet idea of Dr. Dvorkovitch that the bye-products obtained from the distillation of tar would go a long way towards cheapening the price of the oil; and he had succeeded in finding benzol in this tar. But he (Mr. Trewby) was bound to say that their own people, who had had samples of the tar, had not been so successful; and he should like to hear from some of the chemists present whether or not it was in consonance with their ideas that such a thing was possible.

Mr. Carpenter asked if Mr. Trewby had not found any benzol at all.

Mr. Trewby said only traces.

Professor Foster said one point in his mind was the important difference to which Dr. Dvorkovitch referred as being produced by the two pipes. There was no magic in either the ¾-inch or the 1-inch pipe. It was simply a difference of diameter; and he apprehended the reason must be that the result depended upon surface-action, which gave the requisite heat, and caused the vapour to undergo a change. He did not see that there could be any other explanation, except the heating of the gas or vapour passing through the pipe.

Mr. T. May asked if the tar of which Mr. Trewby spoke as being tested, was produced in the same way as Dr. Dvorkovitch had mentioned; because the point appeared to be that, using this small pipe, the gas was obtained as quickly as possible, and this kind of tar resulted.

Mr. Trewby replied that the tar to which he referred was produced in the ordinary apparatus for manufacturing water gas.

Dr. Dvorkovitch said there was a very large manufactory in Russia, not far from Novgorod, where benzol was produced from Russian naphtha. It was not simply an experiment. This factory belonged to Ragosin and Co., who carried on a large trade in it. He was by no means the only person who had found benzol; many other experimenters having obtained large quantities of it, as well as of anthracene, from Russian petroleum.

Professor Foster asked how much per cent. of benzene there was in Russian naphtha.

Dr. Dvorkovitch said he had the figures taken from the printed report of Ragosin's works in 1884. They showed that 1000 kilograms gave 400 kilos. of 50 per cent. benzol. There was no carbolic acid; but 30 per cent. of anthracene, and 20 per cent. of creosote oil and pitch.

Mr. H. Peaty (Burslem) said that he might contribute a few remarks with regard to the carburetting process. In January last he had a Clark-Maxim carburetting plant put up. The cost was a little less than 1d. per candle per 1000 cubic feet. He could not give the amount produced per gallon, as he included it with the make. The fact remained that they were able to produce an extra candle or two whenever necessary, when the cold weather came, and so raise the gas from 15¾ to 17 candles. At present, for the last two or three months, the returns furnished by the Gas Examiner were about 17 candles; while the Corporation never pretended to give more than 16 candles before. They used carburine, which cost just under 1s. per gallon delivered. The great advantage was that a manager was able to bring his gas up to exactly the standard required by his committee or the authorities.

Mr. A. G. Glasgow said he might reply to the question whether anyone had made experiments with regard to enriching 16-candle gas up to 20 or 22 candles. For two years, from 1888 to 1890, he had charge of the Kansas City Gas-Works. They made there about equal parts of 16-candle coal gas and about 40-candle water gas, which was mixed and distributed as 27-candle gas; producing a very satisfactory flame, free from smoke. The reason why just this proportion was adopted was to get as high a sale for the coke and tar as possible; because they were away from any foreign market for bye-products. They had to dispose of them locally; and their object was to

make the quantity they could sell at the highest price. With regard to the point which had been raised by Mr. Carpenter, as to the discrepancies met with concerning the economy of the Clark-Maxim process, Mr. Lacey had stated that at Bromley 12½ gallons of oil were required to raise 16-candle gas one candle. His (Mr. Glasgow's) own experience figured out, as near as he could get it, that he required, in order to raise 20-candle gas about 3 candles, 1·75 to 2·25 gallons of oil per 1000 cubic feet, or about 0·75 gallon per candle. This was about one-half what was needed at Bromley. At Rotherhithe, the quantity required, if he recollected rightly, was about ¼ gallon per candle. This smaller figure was the amount wanted to raise a higher candle power gas, which, of course, would need more oil, as Mr. Browne had very well stated in his paper. The higher the quality of the gas, the more it required to raise it. It was just like mixing hot and cold water; the cooler it was, the more hot water had to be used to raise it to a certain heat. He understood this was the point to which Mr. Lacey had called attention in his curve diagram. The higher the lower candle power gas was, the more of a given candle power had to be put to it to raise it to a given quality. Referring to Table D in Mr. Lacey's paper, taking the average result quoted there, as he understood it, there were 15 gallons added per 10,000 cubic feet, or 1½ gallons per 1000 cubic feet; and the entire increase of illuminating power was 5·13 candles. Dividing this out, he obtained something like 0·29, or about one-third of a gallon per candle power per 1000 cubic feet.

Mr. Lacey remarked that this was when using 15 gallons of oil.

Mr. Glasgow said it was put in by different increments.

Mr. Lacey said it was not fair to take the 15 gallons, and divide it by the number of candles, or else the curve shown on his diagram would be a straight line.

Mr. Glasgow admitted that he might have misunderstood it. He went on to say that another question which interested him a great deal was to know where the determination of candle power was made in the case of the vapour, and whether it was observed promptly after it had been started or after some interval of time. The necessity for having some conveyor of the oil when cracking was very important. There was nothing truer than that, in order to get proper efficiency from oil when cracked in a retort, or whenever it was, it must be cracked in a current of gas, which would support it, and carry it away. Otherwise it was apt to fall; and if the retort was not perfectly sound, it would pass through and condense on the outside. In both systems of water-gas manufacture—Lowe's system and that of Tessié du Motay—the oil was introduced with the gas; in the latter, as it went into the retorts it was fixed. At first sight, this would seem to make it necessary to use a considerably larger retort, as about one-third of the gas made from the oil mixture would pass through four times as soon.

Mr. Browne said the question of retorts had been alluded to by several speakers. He had very much hoped that he should find it practicable to make his oil gas in clay retorts, for the obvious reason that, if this process could be carried on in ordinary retorts, more people would try it, and they would sooner arrive at some definite conclusion. Mr. Botley had found himself unable to employ a clay retort, whether vertical or horizontal; while Mr. Foulis had been successful with a horizontal clay retort. He thought one could get what was wanted from an ordinary horizontal clay retort, if the oil was sprayed into it; but if it were run in by gravitation, it would go through the retort. Spraying was a costly process. This had led him to the idea that there might be placed in the retort an iron tray, in which the oil could be vaporized before it was gasified. The objection to this was that the process must be a continuous one under these circumstances. They had to settle the question whether the enriching should always go on to the same degree and extent, or be intermittent. If it were intermittent, the retort would have to stand off from time to time, and then it would become leaky, if, in the meanwhile, it could not be used to carbonize coal. Mr. Glover said he was disappointed with the Rotherhithe experiments; and so was the man who made them. The President had alluded to the many discouragements and difficulties met with in making a series of experiments in this direction; and he was glad to find that his results were not so good as might be obtained. Mr. Glover had said that he thought Professor Lewes's paper put a more cheerful aspect on the matter. Of course it did. He (Mr. Browne) was glad to find that his results might confidently be expected to be improved upon. Turning to the second table in his paper [*ante*, p. 899], it would be found that, with regard to 50-candle gas, the average was 60 cubic feet per gallon; the highest being 76 feet, and the lowest 52 feet. In order, however, that he might not overstate the case for oil gas, he took the yield as being slightly less than his lowest figure—viz., 50 feet per gallon. But he obtained on one occasion 76 feet; the average was really 60 feet. Mr. Carpenter raised some pertinent questions—one as to the great discrepancy between his (Mr. Browne's) results and those given by other gentlemen. A great deal turned upon the burner used. This was with reference to the Clark-Maxim apparatus. In making the latter experiments, he always used an Argand burner. But before enriching the gas, he took it at the uniform height of 3 inches, noted the consumption, and calculated it to 5 cubic feet per hour. He then did the same with the enriched gas. If coal gas were enriched highly, it could not be tested fairly at the 5-feet rate, as the gas would tail over the chimney. On the other hand, if a gas of low illuminating power were tested at that rate, one did not get the illuminating power it was capable of developing. This might be the reason for some of the discrepancies alluded to; and some definite basis must therefore be adopted in making such comparisons. Then Mr. Carpenter referred to his having stated that 100 cubic feet of vapour were obtained from one gallon of ·680 spirit, which was a much better rate than Mr. Lacey had given. But the statements made in the paper were slightly incorrect. The figures had been incorrectly copied from a paper recently read by Mr. Clark, giving the result of the Maxim-Clark process; and there Mr. Clark stated that 1¼ gallons produced 100 cubic feet, which worked out to 80 cubic feet per gallon of ·680 spirit. His own experience confirmed this. If it were true that they obtained 80 cubic feet of vapour from a gallon of spirit, it certainly was extraordinary that he found it took a quart to enrich 1000 cubic feet one candle, whereas others found it required a pint. If the statement that it only took one-eighth of a gallon to raise the gas one candle were correct, the value of the vapour per 5 cubic feet must, as a matter of figures, be 117. If, on the other hand, the statement was confirmed that it took one-fourth of a gallon, the value of the vapour per 5 cubic feet was only 67 candles. Perhaps Professor Lewes would tell the meeting which he thought most likely—whether ·680 spirit would produce 80 cubic feet of 117 or of 67 candle gas. Again, with regard to what it actually did take, Mr. Lacey, in Table D in his paper, found that, to enrich 10,000 cubic feet from 15·3 to 17·8 candles, it took 5 gallons, or 1·25 candles for 2·5 gallons per ton; and this was singularly near his own figures. Professor Lewes, in one of the Cantor Lectures delivered by him at the Society of Arts in 1890, stated that the cost of enriching 16-candle gas up to 17½ candles per 1000 cubic feet by cannel was 4d.; and by the Maxim-Clark process, 2·6d. If the 1½ candles were reduced to 1 candle, the 2·6d. would come out about 1·75d. for the ·680 spirit; and this was again very near his own result. The only other matter to which he need refer was in connection with the tar or residual oil condensed from the manufacture of Russian oil gas. He had found that the condensed oil had enriching power on coal gas, if the gas were washed with it. The Russian oil, as delivered, had no effect of this kind at all, if the gas were passed through a washer filled with the oil before it was retorted; yet if they subsequently procured the residual oil from the retort, and tried the process again, the coal gas would be found to take up a certain amount of illuminant.

Professor Lewes said Mr. Carpenter, referring to his statement about the deposit of carbon in the porcelain-filled tube, wished to know how it was that, with such a small quantity of hydrocarbons present in the gas, he could have arrived at the result he did. The large portion he obtained was only 0·03 of a gramme; and Mr. Carpenter would understand that as he obtained 1-200th of that only in the second experiment, the quantity of hydrocarbons in the original gas did not require to be very large. In the one case, there was only a very small quantity decomposed; but this happened to be 200 times as great as that deposited

when the diluted gas passed through—showing clearly that some action was going on. Several gentlemen had spoken of the necessity for a conveyor or carrier, or some other vehicle for oil gas, during the cracking; but he would suggest that a better expression would be to call it a "cushion." It was really a cushion for supporting the oil gas and preventing it being over-cracked. When one had these molecules of heavy hydrocarbons all huddled up together, they were far too apt to be over-broken. The action started and spread through them with much greater rapidity than when they were diluted and kept apart by an inert gas. Probably the most important point to bring out was that, by dealing in this way, they really enlarged to an enormous extent the range of temperature they could use. He defied any man of practical skill to keep retorts within 50° or 60° of the same temperature—he could not do it; and therefore the limit of temperature was too narrow. But if the gas were diluted, this limit was enlarged; and instead of having to regulate it to 50°, he would have a margin of 200° or 300°, which made it a much more reasonable process altogether. With regard to the controversy which had cropped up of clay *versus* iron retorts, he fancied some speakers had been rather at cross-purposes on the subject. Mr. Foulis, whose results everyone knew to be absolutely reliable, found he could use clay retorts, while others could not do so. He imagined that in Mr. Foulis's case the oil was led down through the whole length of the retort in an iron pipe, before it was discharged into the clay retort.

Mr. Foulis remarked that this was so.

Professor Lewes said this was totally different from passing the oil in by gravitation. If this was done, the oil went as a liquid practically on to the surface of the clay. In a liquid state, and also at the first moment of vaporization, it had an enormous penetrating force; and he did not believe any clay retort would keep it in. But if they had the retort up to a high temperature, and led the oil down by an iron tube, they never had much of the oil itself getting on to the bottom of the retort; and if they were working at the heats usually employed in cracking oils, all the oil was practically converted into vapour before it reached the end of the iron tube. Then the vapours, in their turn, cracked against the hot sides of the retort. Mr. Browne had given many admirable points in his paper; but he (Professor Lewes) was inclined to quarrel with one small matter, and that was the colour of the gas. He did not think, if Mr. Browne had his gas of a light yellow colour, he was getting the full effect out of it. It ought to be a little darker. Oil gas, to be at its best, was a rich chocolate brown. They must avoid any blackened tint, because directly the gas was a little sooty they were overdoing it; but they must have a good rich brown before they could have high illuminating power combined with a fair yield. The white colour showed that the product was principally vapour, and only a very small quantity of true gas. Where it was a chocolate brown as it left the retort, it had about the maximum illuminating power. Mr. Browne gave him a most unpleasant task in asking him to arbitrate between him and another gentleman as to the cost of enrichment by the Maxim-Clark process; and he quoted some figures from a Cantor Lecture, delivered nearly two years ago, in which he made out the price, if he remembered rightly, to be something like 1½d. At that particular time, the gasoline employed in carbonizing was costing 1s. 2d. a gallon; but being used in large quantities brought down the price to 8d. a gallon. His own impression was that the cost by the Maxim-Clark process would be about 1d. per candle power; but he did not wish to speak too definitely. Several other points had cropped up in the course of the discussion. One gentleman had found that injecting steam increased the illuminating power. This was really diluting; but it was doing it in rather a costly way. When steam was injected, water gas was being made in a most costly fashion, by letting steam and a heavy hydrocarbon re-act to give hydrogen and carbon monoxide, which then acted as a cushion, and brought out an increase in the hydrocarbons by preventing over-cracking. Dr. Dvorkovitch had given a very elaborate account of the importance of the residuals—a question into which he should like to go fully. He meant to do so at a meeting of the Society of Chemical Industry in the course of a few weeks; but there was not time to do it then, as it was a problem covering a very wide field. In Russian petroleum there were hydrocarbons of great complexity; and when they had them breaking up under the influence of heat, they were gradually being broken down and built up again as they went through the length of the retort. An enormous difference was found in the residuals and in the gas obtained, simply because if, after the gas was made, it was kept passing along hot surfaces, some most marvellous changes would take place in the gases themselves—changes which had not been thoroughly and properly investigated. This was the reason for the difference in these tars; and he had not the least hesitation in saying that, from the tars that Mr. Trewby was making from the water-gas producers, he would get practically no benzol, or very little. If, however, oil gas was obtained by cracking the oil alone, then undoubtedly benzol would be had in very large quantities. This was plainly shown by the fact that, in making Pintsch's oil gas, if they took it just as it was produced, and compressed it into cylinders for railway carriages, they would obtain, for every 1000 cubic feet compressed, nearly a gallon of hydrocarbons, containing 50 per cent. of benzene and toluene; showing that these had been formed in that method of manufacturing oil gas.

Mr. Lacey said the question of cost seemed to be one on which the greatest difference existed. He would point out that he was not responsible for the figures supplied to him by Mr. Wright; but they agreed very fairly with those given by Mr. Gandon, Mr. Peaty, and also by Mr. Frank Livesey. Mr. Wright gave 1·25 gallons for each candle added to 10,000 cubic feet of 15½-candle gas to bring it up to 16½ candles. He understood it was tested with an Argand burner, in the same way as that followed by the official tester. This was a different system from that adopted by Mr. Browne. In his own case, he found it required 1·74 gallons to raise the gas from 20 to 21 candle power, using the flat-flame 20-candle burner. He did not think that with this burner there was so much difference, by a candle or two, between 20 and 23 candle power, as with the Argand between 15 and 17 candles. Mr. Glasgow seemed to have rather misapprehended the object with which the diagram had been drawn. He (Mr. Lacey) was not surprised to find that the increase in illuminating power was not equal. He merely stated the fact that, as a mere matter of calculation of candles, it ought to be equal; and if it were not, some explanation was required which they had not yet had. The use of steam in injecting oil was of considerable importance. If he understood rightly, Mr. Foulis employed steam in his experiments. He (Mr. Lacey) found that, when he tried to make oil gas without the use of steam, they were much troubled with carbon deposits, and also obtained bad results. He did not say that without the use of steam he might not have arrived at better results; but he found it considerably reduced the deposit. It might be imagined that, when steam was used, it was decomposed into carbonic oxide and carbonic acid; but, as a matter of fact, this did not occur. He had made many tests, and did not find either carbonic oxide or carbonic acid.

Professor Lewes remarked that it was entirely a question of temperature.

Mr. Lacey said they were not produced at the temperature he employed. The use of steam appeared to be to carry the gases forward. If it was decomposed, there must be present either carbonic acid or carbonic oxide; and there was no appreciable amount of either. One gentleman asked if it was possible to enrich 16-candle gas up to 20 or 22 candles. He (Mr. Lacey) had done it, at a certain temperature, in the laboratory. It was a question of the saturation-point of a gas at that particular temperature; and this was his reason for going into the question of the vapour tension of these oils at different degrees of heat. It would be found, taking it on the assumptions he had taken (some, of course, were only assumptions), that there was a distinct limit. It would be found necessary, when the weather was getting cold, to use liquid of low boiling-point; but when the temperature was 60° or 70° Fahr., there was no reason why they should not employ oil of a boiling-point far above that of water to add one candle. When, however, the temperature fell, this gas might not be permanent. The figures given as to the vapour tensions, showed the enormous influence temperature might have on the quantity of vapour that could be held in the gas. One point of some interest which had come up was that of passing oil gas into tar. But there was a slight tendency to mix up the question of the solution of these oils, and their absorption by different liquids, with their

permanency and the deposition of their vapours, which were two entirely different things. Gases of 60 or 70 candle power might stand a very low temperature; but if they were brought into contact with tar or some other oils, a great deal of the lighting power might be lost, and this would be sheer waste. If by over-saturating the gas, the tension became too high, the low-tension vapours tended to be deposited; but there was no necessity to bring these vapours in contact with any absorbent which would simply take them out.

The PRESIDENT said there had been a very interesting discussion; and the members were much indebted to Professor Lewes and the other gentlemen who had contributed so fully to their information. One fact had come out very prominently in the discussion—namely, that in the manufacture of gas from oil the greatest possible attention should be paid to the amount of surface contact. Professor Lewes, in his paper, said he used a retort 4 inches in diameter. Dr. Dvorkovitch advocated tubes still smaller; and it seemed that in this direction they should attempt to perfect the manufacture of oil gas, if it was to be pursued at all. Mr. Fiddes had referred to his experiment of mixing a small quantity of oil with coal, and carbonizing it in the ordinary way; and he objected to it as an unpractical process. He was quite right in so doing; but he (Mr. Hunt) did not put it forward as practical. The value he attached to it—assuming, of course, the correctness of the test—was, that it seemed to show that there was an illuminating value in the oil higher than they could at present get by gasifying; and that they should endeavour to perfect this means, so as to arrive at the standard which seemed capable of being obtained by the mixture of coal and oil. He was not deterred by Mr. Foulis's adverse remarks on the process, because he knew that the experiments were very carefully made; and although it was not always easy to explain how the results had been obtained, he had no doubt whatever that the record was accurate. He was confirmed in his view of it by what had fallen from Professor Lewes and other gentlemen who had obtained better results by securing what the Professor aptly termed a cushion for the gas as it was produced. He concluded by moving a vote of thanks to Professor Lewes and to Messrs. Browne, Lacey, and Pryce, for their able contributions.

Mr. CARPENTER seconded the proposition; and it was carried unanimously.

The meeting then adjourned till the following morning, when the two remaining papers—those by Messrs. Paddon and Goulden and Mr. Frank Livesey—were taken. The report of the discussions on these will appear next week.

The Final Step in The Gaslight and Coke Company's Assessment Appeals.—On Monday last week, Sir P. H. Edlin, Q.C., sitting at the Sessions House, Clerkenwell, finally closed the proceedings in the assessment appeals of The Gaslight and Coke Company, which were fully reported in the JOURNAL during their progress from July to March last, by initialling the alterations in the valuation lists in those parishes in which the Company were successful in reducing their assessment. It may be remembered that, when judgment was given in the appeals, it was found that, in the case of many of the parishes concerned, the appellants had not only failed to reduce the assessment, but that this was, as a matter of fact, already too low. As, however, the Court had no power to raise the figure, the old assessment would, in the ordinary course, have stood until the next quinquennial valuation. We now learn that the Company have consented to be rated in these parishes at the higher values fixed by the Court—a decision which Sir Peter Edlin has pronounced to be highly creditable to them.

Death of the Chairman of the West Ham Gas Company.—We regret to record the sudden death, on the 16th inst., at the age of 75, of Mr. John Frederick Nicholson, F.R.C.S., Chairman of the West Ham Gas Company. He had been a Director since 1863, and a member of the Finance Committee for practically the same time; and he had consequently acquired a valuable and intimate acquaintance with the Company's affairs. During his chairmanship of two years, Mr. Nicholson gave unremitting attention to the duties of his office, and spared himself no trouble in carrying them out. He was much respected by his colleagues and the officers. Mr. J. Lister Godlee is Deputy-Chairman. The management of this Company has sustained heavy losses from death during the past year or two. It is scarcely two years since we had to record the decease of Captain Pelly, R.N., the Chairman, followed at no great interval by that of Mr. John Meeson, also a Director of long standing; while Mr. E. H. Thorman, the Engineer of the Company from its formation, and Mr. J. Madge, who had been Secretary for 22 years, have also passed away quite recently.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 982.)

THE revival of business in the Stock Markets has not made so much progress during the past week as might have been expected. In fact, it is not too much to say that there has been a decided lull. Why this should be, is not quite apparent. The snapping of the "nimble ninepence" by realizations had to do with it, to an extent; but beyond this there seems to be something like a recrudescence of cautiousness which keeps speculators hovering on the brink. The result is that prices for the most part have fallen, even of the best class securities. The check is probably only a temporary phenomenon, and it may fairly be expected to be followed by another step in advance. One potent factor remains unchanged, and that is the cheapness and abundance of money. The Gas Market meanwhile has been rather irregular. It was brisk enough at first; but after the first few days it tailed off quiet. Gaslight issues had fully the lion's share of attention; and the "A" stock underwent some slight revulsion after the liberal advance it had effected in the previous week. This was quite in accord with the move elsewhere to realize profits. The tendency was marked from the opening bargain, which was done at 216; and figures gradually lowered until on Friday 210 was reached. The quotation, however, only suffered to the extent of 3 in the aggregate. The secured issues of all sorts were fully active, and good prices were realized, especially for the debenture stocks. South Metropolitans were scarcely so active as they have been recently, but were more than equally firm; and the "B" rose 1½. Commercials were quiet and unchanged. The Company have issued letters of allotment of £35,000 debenture stock at par among the proprietors, to provide capital to meet the requirements of the business. The Suburban and Provincial Companies exhibit the same degree of quiet; and the only move is an advance of 1 in Brentford new. The Continental Companies are a shade easier; both Union and Imperial having receded one point. Changes throughout the rest of the list are few and unimportant. Melbourne debentures are 1 higher; but Buenos Ayres has lost the ½ which it gained the week before. The Water Companies continue steadily to amend; and gains of from 1 to 5 per cent. were effected by various undertakings, as set forth in the list.

The daily operations were: A good deal was done on Monday in Gaslight "A;" but little else was touched. Quotations held good. Tuesday's business was on much the same lines; but Gaslight "A" fell 1. South Metropolitan "B" rose 1½; and Melbourne, 1. In Water, Lambeth 7½ per cents improved 2; and Grand Junction, ½. Gas was very quiet on Wednesday; but prices looked down—Gaslight "A" and Imperial Continental each receding 1. New River rose 5; and East London, 1 But West Middlesex was 1 lower. Gas continued very quiet on Thursday; and the only move was a rise of 1 in Melbourne. Friday was slightly more active; but prices were unfavourable—Gaslight "A" and Continental Union losing 1; and Buenos Ayres, ½. Saturday was almost a blank day; but Brentford new rose 2. Grand Junction Water also advanced 1½.

ELECTRIC LIGHTING MEMORANDA.

The Affairs of the Chelsea Electricity Supply Company—The Bradford Experiment—French Measurement again Denounced—Mr. W. H. Preece on Interior Lighting.

THE ordinary general meeting of the shareholders of the Chelsea Electricity Supply Company has been held, when accounts relating to the second complete year of working of the undertaking were received and adopted. The system of distribution selected by this Company differs from all others in London; and there are other considerations which render the experiences of the venture interesting to followers of the fortunes of electric lighting speculations. The number of lamps (reduced to the 8-candle standard) served by the Company up to the end of the year was 27,500, upon which a gross revenue of £10,172 was received; and the accounts show a gross profit of £1750. Like the other London companies of the same order, the Chelsea concern still has an open capital account, and has found it necessary to issue some first mortgage debentures in order to keep the wheels going. From some expressions dropped by the Chairman (Mr. J. Irving Courtenay) at the meeting, it may, however, be gathered that the Board have reconsidered the resolution at which they had arrived a year ago, to extend the mains into new districts. Consequently, the large increase of income which was expected to be secured in this way has not been realized; but the Board are deserving of praise for their prudent putting on of the brake. They seem to have awakened to a sense of the danger of "outrunning the constable" sooner than some Boards of similar companies; and it will be of the greatest interest to see how they will fare while awaiting the development of the district already occupied by their mains. Confining himself to the prospect permitted by this policy, the Chairman thinks the Company ought to earn £13,000 during the current year; and if they can do so, and

make a profit of 2¼d. per unit, he expects to be able to recommend a 4 per cent. dividend on the share capital, after paying the debenture interest. If the Company can accomplish all this, they will be fortunate indeed.

When, a fortnight ago, we briefly mentioned Mr. J. N. Shoolbred's Society of Arts paper upon the Bradford Corporation electric lighting experiment, we were unable to discuss the contents of the paper, or to state how it was received by the author's friends and rivals in the same line of business. From some disparaging remarks originating with partisans of electric lighting systems differing from that adopted by Mr. Shoolbred, it may be gathered that these interested critics are inclined to dismiss the paper as mere advertisement of the author and of the contractors for the electrical plant supplied, according to his designs, to the Corporation of Bradford. It was not quite so bad as this, however; and we are ready to admit that the number of the *Journal* of the Society containing the text of the paper and the discussion upon it, should be procured and studied by all members of municipal corporations, &c., interested in the subject, who will find therein some instruction and not a little warning. Among other things is to be noticed the statement of accounts relating to the undertaking, which allow it to be seen, on the face, that during the last half year the cost of the Board of Trade unit, as produced at the Bradford station, was only 2·47d. This figure, however, does not include capital or administrative charges of any kind, nor office expenses, nor, of course, profit. It therefore seems fair to classify these accounts among the many similar statements that have been published, which, if they contain the truth, certainly do not express the whole truth, and leave the world as much in the dark as ever respecting the actuality of the financial circumstances of central station electric lighting.

There was an interesting discussion upon the general subject of lighting at the Institution of Civil Engineers last Tuesday, following upon a paper by Mr. A. P. Trotter, which is dealt with elsewhere. It is mentioned here, however, for the purpose of placing upon record the scorn and contempt that was poured, by all the speakers who happened to refer to the matter, upon the nominal "2000-candle power arc lamp." The proper way of describing this well-known appliance is to call it a "10-ampère lamp;" and this is the only term recognized as applicable to it by respectable engineers who speak or write under a due sense of responsibility for the language they use. Yet the "old crusted lie," as Mr. Trotter has called it, appears in the entry of the Brush Company's contribution to the Crystal Palace Electrical Exhibition; and whenever there is a street lighting contract to be snatched, it is paraded in Brush estimates with the greatest assurance. It is used to exaggerate the advantages which electrical touters so lavishly promise to local authorities who do not know better, if they will only abandon gas, and take to electric arc lighting for their streets; but we, at any rate, do not mean to cease from calling attention on all possible occasions to this Anglo-American sophistication, with a view to putting prospective victims of the electrical touters (hailing mainly from the Brush head-quarters) on their guard, until this disgrace to the electric light business is finally dropped as useless.

Mr. W. H. Preece, F.R.S., read a paper yesterday week, before the Royal Institute of British Architects, upon "The Art of the Internal Illumination of Buildings by Electricity." The only thing that should trouble this most prolific discourser on and about electric lighting is the titles of his papers, letters, and speeches; for the matter is always necessarily pretty much the same. People seem willing to take them, however, and when the number of these efforts on the part of the Post Office Electrician is remembered, the marvel is that the author should be so successful as he is in freshening up his stock ideas in order to suit his varying audiences. In speaking to architects, of course, it was necessary to talk about interior lighting. Having quietly effected the alteration of his proposed standard of diffused light, the "lux," into the more practical candle-foot, while retaing the fancy name, Mr. Preece told the assembled architects that the necessary illumination of interiors could be provided for by allowing a consumption of one watt per square foot of floor surface in incandescent lamps applied to this purpose, or allowing one 16-candle lamp, at a height of 8 feet from the floor, per 8 feet square of the floor surface. If anybody but an eminent electrician had propounded such a recipe, it would have been called a piece of "rule of thumb;" but, of course, there is never anything of this kind in the work or counsels of experts in electricity.

Manchester District Institution of Gas Engineers.—The spring excursion of this Institution is fixed to take place next Saturday; and we learn from the Honorary Secretary (Mr. S. S. Mellor, of Northwich) that arrangements have been made for a trip to Skipton, Bolton Abbey, and Bolton Woods. An early start will be made from the Victoria Station, Manchester, so that Skipton may be reached about eleven o'clock. After luncheon, there will be a little formal business, including the election of Mr. G. R. Pickering, of Cheadle, as a member. Conveyances will then take the party to Bolton Abbey, after visiting which they will proceed to Bolton Woods and the Strid. They will return to Skipton to tea; and leave for Manchester about six o'clock. With fine weather, this excursion should be simply delightful.

ILLUMINATION AT THE INSTITUTION OF CIVIL ENGINEERS.

In another column of our present issue will be found the abstract, issued by authority of the Council, of the paper by Mr. A. P. Trotter upon the "Distribution and Measurement of Illumination," which was read before the Institution of Civil Engineers at the ordinary meeting on Tuesday, the 10th inst., and discussed then and at the following meeting. The text of the paper, with the discussion upon it, will only see the light in the published Minutes of the Proceedings of the Institution; and, as these will not appear for some months, we propose to acquaint our readers with the gist of Mr. Trotter's contribution to the scanty literature of this important subject, and the general purport of the debate provoked by it.

The paper is very long, and, at the first glance, of formidable aspect. This is due to the number and apparent complexity of the diagrams deemed necessary by the author for the due treatment of his subject. Essentially, the matter so elaborated is simple; being nothing more than just such another study of the intensity and distribution of the light emitted by street lamps as was set out in elementary style in the series of articles upon "Lighting" contributed by Mr. W. H. Y. Webber to the Journal from September to March last. Indeed, Mr. Trotter referred to these articles, which, he said, appeared after the greater part of his paper was written; and there is a marked degree of correspondence between the two authors, who thus independently arrived at similar results by studying the operation of the optical laws which govern the phenomena of artificial lighting. Mr. Trotter introduces his subject by referring to the curious neglect of the practical problems of artificial lighting by writers of optical treatises; from which it follows that those whose business it is to deal with such problems have failed to take account of the laws of Optics in their ordinary work, and have proceeded by empirical rules to obtain the effects they desired. Yet, although they have been ignored, the laws of Optics are not to be disestablished by lighting engineers; and it has been Mr. Trotter's care, as it was Mr. Webber's, to bring technicians interested in the problems of artificial lighting to a sense of the benefit they may derive from a systematic study of such optical laws as properly apply to their work, and to cure the lighting industries of the plague of charlatanry which neglect of science has brought on them.

Mr. Trotter defines and describes the factors of which illumination consists, and adopts the parliamentary standard candle as his unit of light, and the candle-foot, or the light given by one candle at a distance of one foot, as his unit of illumination. He compares this unit with others suggested or in actual use; and he concludes that it is the natural one to employ in conjunction with the system of measurement in common use in the United Kingdom. He gives a method, however, whereby the conversion of candle-feet into French bougie-metres, or contrariwise, may be effected. Unfortunately for the assimilation of illumination measurements to others in ordinary use by engineers, the radiation of light proceeds by geometrical, and not by simple arithmetical progression; and consequently, as Mr. Trotter admitted in replying to the discussion on his paper, the term "candle-foot" is not such a simple expression as the foot-pound or the inch-ton employed in the calculations of mechanical and civil engineers.

To all intents and purposes, Mr. Trotter gave the master-key of all practical lighting problems very early in his paper. He put it in this way: "The nature of the illumination of a horizontal plane by a light radiating uniformly in all directions, is the most simple, and at the same time the most useful and common, problem for outdoor work. . . . The illumination at any point on the plane varies inversely as the square of the distance from the light; that is, inversely as the slant height of the lamp. It also varies as the cosine of the angle of incidence." By reference to a simple figure of a right-angled triangle, the author shows how these conditions are combined in a single expression; for in such a figure, the length of the perpendicular being taken as unity, the cosine of the angle of incidence is measured by the ratio of the perpendicular to the hypothenuse. The resulting formula is $i = \frac{AB \times c.p.}{AC^3}$, where i is the intensity of the illumination in candle-feet, *c.p.* the candle power of the lamp, AB the height of the light in feet, and AC the slant distance from the light to the horizontal spot for which i is to be determined. This is the formula which unlocks all the mystery, such as it is, of the distribution of lighting from street or any other lamps; but it is especially useful for the measurement of street lighting. Mr. Trotter himself says that "by the practical application of the cosine law (*i.e.*, of the given formula), the illumination which will be produced by any given arrangement of lights may be determined." He then proceeds to illustrate this principle by drawing some curves, which, with the help of accompanying tables of values of the cube cosines of incidence angles, enable the illumination curves for the combined effect of a number of lights to be determined by the simple addition of ordinates. He has drawn these curves for four different arrangements, showing the effects produced by a number of lamps spaced (1) at a distance apart equal to their height; (2) at a distance equal to twice their height; (3) at a distance equal to three times their height; and, lastly, at a distance equal to six times their height. This last becomes

mere pilot or beacon lighting. Mr. Trotter appears to think that, for securing a passably uniform effect of illumination by street lamps, as distinguished from pilot lighting, the lamp-columns ought not to be spaced further apart than four times their height. It would be instructive to work out upon this rule the comparative cost of lighting a given thoroughfare according to different systems.

Mr. Trotter fully adopts the view expressed earlier by Mr. Webber, that the actual illumination of the road surface is not by any means the only important result procured by street lamps; and that the use of the latter as beacons to mark out the way is of very great value. Mr. W. H. Preece, in the course of the discussion, talked much nonsense about the possibility of the loss of life in the streets of London being due to the fact of the public lamps being upon the scale of pilot lights rather than on that of illumination. But Mr. Trotter frankly declared that the smallest street lights are immeasurably better than none; and it did not occur to Mr. Preece as possible that the glare of the dazzling arc lamps, at 50-yard intervals or more, suspended, as they usually are, at a height which brings them directly before the eyes of drivers of vans, omnibuses, and other lofty vehicles, may be more detrimental to the safe conduct of street traffic than the more equable, if dimmer, pilot gas-lamps.

Mr. Trotter lays down the proposition that "illumination begins to be useful when it is comparable with moonlight." Out of a number of measurements made by the author about the time of full moon, none has ever reached a higher value than about 1-36th of a candle-foot; that is, the light given by a candle at 6 feet. In London, a bright moon, well up in the sky, generally gives about as much light, according to Mr. Trotter, as a standard candle at from 8 to 10 feet distance. This measurement is for direct moonlight, and does not include the effect of the diffused light of the surrounding sky, which is often considerable. Bright as moonlight sometimes appears to the eye, because of its perfect uniformity, it is never otherwise than feeble. In this country, moonlight is never bright enough to render a page of "Bradshaw" legible. Mr. Trotter very wisely says that while in outdoor lighting the illumination of the ground cannot be held to be everything, and the horizontal and angular lighting of objects upon the ground is often the principal consideration, it is nevertheless best to aim at a fair illumination of the ground, as being the most difficult object—and, we may add, the farthest from the light-source. If the lighting is improved by reflection from surrounding walls of buildings, so much the better; but this should not be taken into account when computing the intensity required.

The paper comprises a number of plotted examples of street lighting; the intensity of the illumination being indicated by contour lines drawn at some constant difference, say, of 1-10th or 1-20th of a candle-foot. The effect presented by this contouring is peculiar, and, we venture to say, rather bewildering than helpful. It does not correspond with anything in nature or art; and it is a painful illustration of the misapplication of a device borrowed from one branch of science to another. The author's unhappy idea of contouring his lighted areas is responsible for the false appearance of difficulty imparted to the subject under notice. It may sound horribly unscientific to admit the impeachment that the best street effects in the way of gas lighting have been arrived at by simply putting up a lamp, seeing how it looked, and then adding to the number and power of the lamps until the desired end was achieved; but it is to be feared that the sight of Mr. Trotter's diagrams and contoured plans will frighten many men from attempting to treat lighting problems "scientifically." After all, the effect is the thing; and we imagine that nobody would call a modern Atlantic liner or a battle-ship an unscientific production because it is not evolved as a perfect fruit of the designer's inner consciousness, but represents the net outcome of an infinity of trials and errors.

Mr. Trotter said nothing to the purpose about the lighting of interiors; and his paper therefore failed of a part of its scope. In Mr. Webber's articles it was shown how interior lighting may be computed with reference to a preconceived standard (see *ante*, p. 292); but, although challenged upon the point, Mr. Trotter ignored this problem. The greater part of his paper was filled with an elaborately detailed account of various photometers for diffused light; including an ingenious device of the author's own, which he has used, with much personal satisfaction, in testing various examples of lighting. It is almost a pity to say so, but, in point of fact, Mr. Trotter's labours in this respect have been almost thrown away, for they have done little more than verify the results of very easy calculation.

The paper was discussed by Mr. W. J. Dibdin and Mr. W. Sugg, who criticized the author's photometry. An evening was specially appropriated to the discussion, in compliment to the author's labours, and in recognition of the importance and novelty of the subject; but the good intentions of the Council, who desired to have the matter thoroughly threshed out, were nearly frustrated by Mr. W. H. Preece, who spoke for forty minutes, tired his audience, and said no more than could have been stated in a tenth of the time he occupied by his tedious oration, the main object of which was to lay claim to some credit for having suggested a unit of diffused light in 1882, which the speaker wanted to make out to be the same thing as the candle-foot used by Mr. Trotter. This pretension, however, was exposed by the author of the paper, who showed that Mr. Preece's "lux," which nobody ever used, is a quantity referable to the French system of measurement, whereas the candle-foot is commonly employed by many technicians who do not take the trouble to name it. It is a remarkable circumstance that while the electricians and the civil engineers were so interested in the subject of illumination that they assembled in such numbers as to nearly fill the lecture theatre of the Institution, not a single representative of the gas-manufacturing industry was present. Consequently, besides Mr. Sugg, there was nobody to champion the cause of gas in the face of its enemies. Is it that gas engineers do not take an intelligent interest in these matters? Not so, let us hope; but their interest is plainly of the silent sort, which may be seated the deeper for the lack of surface indication of its presence.

Pumping-Engine Duty.—The standard for comparing pumping-engine duty adopted by the American Society of Engineers is the work done by 1,000,000 heat-units in dry steam supplied to the engine, instead of the old basis of the work done with 100 lbs. of coal.

Southern District Association of Gas Engineers and Managers.—The spring meeting of this Association is fixed for next Thursday, when the members and friends will pay a visit to Tunbridge Wells. The programme of arrangements which the Honorary Secretary (Mr. J. W. Helps, of Croydon) has issued, gives evidence of careful preparation for ensuring a pleasant excursion. The party will leave London by a fairly early train; and on their arrival at Tunbridge Wells, carriages will convey them to the gas-works, which are under the supervision of Mr. A. Dougall, the President of the Association. Having inspected these, they will partake of luncheon provided by the Directors of the Company. In the afternoon there is to be a drive to Penshurst, and after tea the return journey will be commenced in time to arrive in London about nine o'clock.

The Federated Institution of Mining Engineers.—We have received from the Secretary of this Institution (Mr. M. Walton Brown) the programme of arrangements for the general meeting, which is to be held at the Institution of Civil Engineers on the 2nd, 3rd, and 4th prox., under the presidency of Mr. T. W. Embleton. The two first-named days will be mainly devoted to business; the last one, entirely to visiting. The papers to be taken on the opening day of the meeting will comprise one on "Petroleum in Eastern Europe, and the Method of Drilling for it," by Mr. A. W. Eastlake; and Professor Thorpe will conduct some experiments to illustrate the phenomena of coal-dust explosions. Among those set down for the second day, we notice one on "The Coal and Mineral Resources of Peru," by Mr. E. Lane; and another on "The Causes of Spontaneous Combustion, and the Prevention of Explosions on Board Ships," by Mr. M. V. Jones. Visits will be paid to the Crystal Palace Electrical Exhibition, the Tower Bridge, and the St. Pancras Electric Supply Station; and, for the convenience of visitors, the programme includes a short description of the two latter.

Midland Association of Gas Managers.—We learn from the circular which has been issued by the Honorary Secretary of this Association (Mr. C. Meiklejohn, of Oldbury), that the next general meeting will be held on Thursday, in the Board-room of the Rugby Gas Company. There will be more business than is usual on the occasion of the spring gathering of the members, inasmuch as the President (Mr. W. Littlewood, of West Bromwich) will be present and give the Inaugural Address which, owing to indisposition, he was unable to deliver at the meeting in Birmingham on the 10th of March. A paper will also be read by Mr. P. Hutchings, on the "Monier Construction System, and its Adaptability to Gas Engineering Work Generally." This system, it may be remembered, was described in an article which appeared in the JOURNAL for Dec. 8 last year (p. 1035). At the close of the business, the members will visit the works of the Newbolt Cement Company and the Rugby Cement Company (also the gas-works, time permitting); and afterwards take a drive, terminating in a visit to the Rugby Schools. On their return, they will be entertained at dinner by the Directors of the Gas Company.

Gas and Hydraulic Power Supply Works in the Colonies.—Mr. John Coates, M.Inst.C.E., of the firm of Messrs. J. Coates and Co., of London, Melbourne, and Sydney, whose firm have done a large amount of good work in establishing gas undertakings in the colonies, is now on a visit to England. Since Mr. Coates commenced operations at the Antipodes about six years ago, he and his associates in business have put up nearly 30 gas-works in various towns in Victoria, South Australia, New South Wales, Queensland, New Zealand, and Tasmania; and they have now in hand Albany (Western Australia), two works for the Government of New South Wales, and the rising township of Zeehan, in the newly-discovered silver-field of Tasmania. Mr. Coates has also carried out most successfully hydraulic power supply schemes in Melbourne and Sydney. In the business portion of the former city, there are now 15 miles of high-pressure mains; and, as an example of the popularity of the system, the two largest employers of this form of power pay the supplying Company something like £2500 per annum. The Sydney scheme will be larger than that at Melbourne; but there are already 11 miles of mains laid. The capital invested in these various undertakings amounts to about £350,000.

HERRING'S GAS-WORKS CONSTRUCTION.*

MR. HERRING, of the Huddersfield Corporation Gas Department, has collected and reprinted in book form, with illustrations and additions, some articles descriptive of the construction of gas-works which he contributed some four years ago to the now defunct *Gas and Water Review*. Making no pretensions to literary style, the author hopes that his venture in book-making may be justified by the utility of the publication; and we are pleased at being able to admit that there is good reason for his aspiration. Although not by any means a brilliant book, Mr. Herring's work is likely to be found useful within a considerable range, and may be conscientiously recommended to students of gas manufacture. The author is gratifyingly modern, and takes no notice whatever of the steps by which his art has attained to its present position. He starts upon the assumption that the first problem for the student is to design a gas-works for a town of stated size; and he shows how this problem may be solved by observance of contemporary practice in such matters. It is a curious thing to say, but the observation is nevertheless true, that the designing of an ideally perfect and new gas-works is one of the very rarest of gas engineering tasks; and to start with it as though it were a commonplace of the draughtsman's office, is not quite the most "practical" way of opening up the general subject. Our author begins by remarking that he may profitably commence "by assuming that the leading inhabitants of a certain town have determined to form a company for the purpose of manufacturing and supplying coal gas for private and public purposes;" but how often is anything of the kind done? Moreover, we are not sure that Mr. Herring gives us all that is necessary for dealing with this comprehensive problem, supposing it to be propounded; for while he tells us what is the average annual consumption of gas per head of the population in different classes of towns, he is reticent as to what might be expected of similar towns newly provided with gas-works, and is also silent respecting the relation of daily production to yearly output in gas undertakings in various stages of their development—which is one of the first things a designer of brand-new works has to consider. After an introductory chapter—which we strongly advise the author to rewrite and expand for any future editions of his book, rather out of his experience than his imagination—he plunges over head and ears into a mass of matter dealing with ordinary building and engineering construction, as applicable to gas-works, of course, as to any other class of factories; but not much more so. It is all good, however, so far as we have been able to test it, and unquestionably ought to be at the fingers' ends of every competent gas-works draughtsman. Whether it is necessary or desirable to reproduce all this general matter under the title of a handbook for specialists, is another consideration. Having regard to the excessive multiplication of text-books, which is one of the plagues of modern technical education, we do not think such reproduction called for; but this may be matter of private opinion. When Mr. Herring gets into the special chapters which he devotes to carbonization, furnace construction, manufacturing and purifying plant, &c., he is a safe and intelligent guide; because here he obviously repeats what he has himself learnt and tested by experience. He is a very painstaking author, and is laudably anxious to tell all he knows. It would have been better, perhaps, if he had not begun to write upon such a serious scale until he had felt able to pronounce with more authority upon some branches of his subject; but on the whole, he must be credited with the possession and exercise of a good deal of discretion in the work of compilation. He will not lead a student wrong, nor fill his mind with a crowd of superstitions—which is no slight praise. The book is well printed; and the illustrations, if not nearly plentiful enough, are mostly modern. If the author had called his book an introduction to the subject of gas-works construction, we should have had less fault to find with it. But, as it is, it is well worth buying.

Mr. Albert Ford has been appointed, out of upwards of 200 applicants, Engineer of the City of Santos Gas-Works, Brazil, for which position applications were invited in our advertisement columns a few weeks ago.

Masonic.—It will doubtless be remembered that some time since mention was made in the JOURNAL of a proposal to have an emergency lodge in connection with the Evening Star Lodge, for the purpose of initiating the son of the W. Bro. William A. Valon, C.E. As, however, Mr. Arthur Valon is only in his twenty-first year, a dispensation had to be applied for, which it has been found impossible to obtain. An emergency lodge will nevertheless be held on the Monday of the Institute week—viz., June 13—at the Freemasons' Hall, Great Queen Street, so as to give provincial brethren an opportunity of meeting the Master. It will also be arranged for the brethren to dine together at the close of the lodge. The Secretary, W. Bro. Magnus Ohren, will send invitations to all provincial members who are known to be masons. Any brother, however, who may not be known as such, on communicating with the Secretary will receive a prompt invitation.

* "The Construction of Gas-Works Practically Described," by Walter Ralph Herring. Illustrated. London: Hazell, Watson, and Viney, Ltd.

TECHNICAL RECORD.

THE DISTRIBUTION AND MEASUREMENT OF ILLUMINATION.

At the Meeting of the Institution of Civil Engineers on the 10th inst., Mr. A. P. TROTTER, B.A., Assoc.M.Inst.C.E., read a paper on the above subject. It was divided into sections—the first dealing with geometrical principles; the second, with photometers; and the third, with the results of measurements made in the streets and public buildings of London. The following is the abstract of the paper that has been issued by the Council of the Institution.

When light falls upon a surface, that surface is said to be illuminated. Illumination consists of two factors—candle power and distance. The carcel-metre was proposed in 1882 as a unit of illumination. Mr. Preece showed that this was equal to a standard candle at 12·7 inches; and he proposed the name "lux" for the English equivalent. The author took the candle-foot as a practical unit. The illumination of a horizontal plane at any point varies as the cube of the cosine of the angle of incidence of a ray of light falling on that point, when the candle power and the height of the lamp are constant. Curves were given, showing this distribution graphically; illumination being represented as ordinates, and distances from the source of light as abscissæ.

The distribution of the total light on a surface varies as the solid angle subtended by that surface at the source of light. The usefulness of a white reflector depends on the solid angle which it subtends, and not upon its absolute dimensions. The resultant illumination, due to a number of lamps spaced at distances apart, equal to once, twice, three times, and six times their height from the ground, was shown by a number of curves. The distribution of the light of a continuous current arc lamp is peculiar. For angles of incidence greater than 50°, it varies as the fourth power of the cube of the cosine of the angle of incidence. Light falling in a more vertical direction is largely reduced by the shadow of the negative carbon.

The object of street lighting is twofold—to mark out the street with beacons, and to provide illumination. Illumination begins to be useful when it is comparable with moonlight. Moonlight in this country rarely exceeds 1-36th of a candle-foot—that is, a candle at 6 feet; and it is generally between 1-60th to 1-100th of a candle-foot. The distribution of illumination in more general cases was treated geometrically; the variation of illumination due to the varying height of a lamp was discussed; and it was shown that there was no particular virtue in the angle of incidence, the tangent of which is the square root of 2.

Calculated contour curves of equivalent illumination due to two lights, at a distance apart equal to three times their height, and to three lights arranged in a triangle, at a distance apart equal to 1½ times their height, were given, together with curves of illumination due to arc lights spaced in a similar manner. The use of diagrams to which the author gave the name of characteristic curves was explained. In several respects these resembled steam-engine diagrams. The co-ordinates were candle power and area; the area of the diagram was a measure of total light, or power in an optical form. The maximum and minimum illuminations in any example could be seen at a glance; and the shape of the curve showed the quality or regularity of the distribution. Characteristics for a square and for a circular area illuminated by a single light, and for several arrangements of uniformly spaced lights, were given.

In the second section of the paper, the author alluded to the different attempts which have been made to supplant photometers by thermo-piles, radiometers, and photographic methods. The complication of gas-testing apparatus was contrasted with the simple forms of true photometers, such as those of Bunsen, Rumford, and Foucault. A photometer was described in which a shadow was thown by a mirror upon a screen, and a reflected beam of light was superposed upon the shadow; the whole screen being of an unvarying tone when a balance was effected. In a direct-reading photometer, a rod was placed nearly in the plane of the two lights to be compared. Two shadows were thrown on a screen, and the position at which the two shadows were of the same tone could be read off on a scale. The illumination photometers of Weber and Mascart were briefly described. The author explained that Mr. Preece's photometer of 1883 depended on the measurement of the current of a small glow lamp. The sixth power of the current was approximately proportional to the candle power. The current was adjusted by resistances. The details of this photometer were discussed; and Captain Abney's method of rapid oscillations in photometric measurement was described. Various errors were introduced by this use of a Bunsen screen, and by the colour of the electric lamp at low candle power. In a photometer designed by the author, in conjunction with Mr. Preece, in 1884, a glow lamp was made to approach or to recede from a Bunsen screen. The motion was given by a lever rolling on a cam in such a manner that the illumination could be read upon a uniformly-divided scale. A number of modifications of this photometer were tried during the past winter, and resulted in the construction of an illumination photometer, with which a large number of measurements had

been made. Two glow lamps, of ¾ and ½ candle power, were mounted in a long blackened box. Either or both could be used at once. Four Lithanode cells supplied the current. A reflecting screen, covered with white paper, threw the light upwards through a star-shaped hole in a horizontal screen of cardboard. The reflecting screen was mounted on hinges, and could be wound up by a fine chain; finally folding quite out of the light. The chain was wound upon a cam; and a hand or pointer was mounted on the axis of this cam, which was so shaped that a nearly uniformly divided scale was obtained. The scale was graduated empirically. Readings were taken when the illumination of the horizontal cardboard screen appeared to be identical with that of the moveable reflecting screen, visible through the star-shaped hole. The range of this photometer is from 2·5 to 0·001 candle-feet.

Measurements were made in the South Kensington Museum, in which illumination of about ½ candle-foot up to 3½ candle-feet were recorded. In the Cannon Street Station, the minimum was 0·025 candle-foot; and the maximum, 0·4 candle-foot. In the Charing Cross Station, the minimum was 0·05; and the maximum, 0·5. Several sets of measurements were made in the City. The result of systematic measurement of part of Queen Victoria Street was given in contour lines of equal illumination. The maximum in an exceptional case was 1·1; ordinary maximum, 0·3; minimum, 0·025. Contour lines were constructed from a considerable number of measurements in Whitehall. The illumination in Great George Street, Westminster, was also measured. The maximum was 0·9; and the minimum, 0·005. Characteristic curves were drawn from these observations; and these enabled the degree and the quality of the lighting to be compared.

The paper was accompanied by an appendix, containing tables of the value of a bougie-metre in candle power at different distances, values of various powers of the cosine, &c.

Softening the St. Helens Water Supply.—Last Thursday the Mayor of St. Helens (Mr. F. R. Dixon-Nuttall) laid the foundation-stone of a building at Thatto Heath to accommodate new machinery for the softening of the water supplied to the borough. The building and plant is being erected at a total cost of rather more than £10,000.

Sutton Coldfield Gas Company.—At a meeting of the Directors of this Company yesterday week, it was decided to wind up the concern, and to accept the offer of the Birmingham Corporation for the mains and distributing plant. The buildings and other works it was also agreed should be sold; and it is believed the whole of the plant and works will realize something like £6000—about £1000 less than the sum for which they were offered to the Sutton Corporation. Reference to this matter is made in the annual report of the Birmingham Corporation Gas Committee, some extracts from which appear in another column.

Tarapaca Water-Works Company, Limited.—The annual general meeting of this Company was held on Monday last week, at Winchester House, E.C.—Mr. R. Harvey (the Chairman) presiding. The report presented stated that the profits for the past financial year were £44,068, which, with £21,983 brought forward, made a total to the credit of the profit and loss account of £66,052. Including the dividend paid on the 6th of April, two others of 5 per cent. each, or 10 per cent. for the year, amounting to £40,000, had been paid, after deduction of which, with the £310 reserved for income-tax, there remained an available balance of £25,742. From this the Directors proposed to write off £1500 from the preliminary expenses, to place £5000 to a reserve fund, and to carry forward the balance of £19,242. In moving the adoption of the report, the Chairman said that the profit was less than last year, owing to political troubles. Although these had made a considerable difference in the receipts, it had not prohibited them from making a very handsome profit. Many circumstances had militated against them; but the greatest of all was the fall in the rate of exchange. Their works had not been injured in any way during the recent war in Chili; indeed, the only loss they had suffered was in the sale of water. From the commencement of the Company, £109,807, or upwards of 25 per cent. of the capital, had been paid in dividends. The branch supply to the mines of Huantajaya, and other separate water deposits on the Pampa, had developed into important sources of income. The motion was carried.

The Progress of the Colne Local Board Gas Department.—A very encouraging report on the working of the Gas Department during the past financial year was presented by Mr. Hartley at the meeting of the Colne Local Board last Friday week. He stated that the gross receipts had been £2153 in excess of the previous year; and the total profit was £1095, as against £592. Coal had advanced 2s. 3d. per ton; but if it had been at the same price as in 1890, the profit would have been £1943. The gross cost of manufacture amounted to £10,012, as against £8656; and interest on loans came to £1837, as compared with £1545. The total receipts amounted to £13,353, as against £11,200. To show the progress of the works during the last three years, Mr. Hartley said the profit was £426 in 1890, £591 in 1891, and £1095 last year. The quantity of gas made was 74,070,000 cubic feet in 1892; 64,662,000 cubic feet in 1891; and 58,373,000 cubic feet in 1890. Wages had advanced from £1857 in 1890 to £2120 in 1892; and the unaccounted-for gas had decreased from 8·7 per cent. in 1890 to 8·3 per cent. in 1891, and 8 per cent. in 1892. The sale of coke had increased from 1805 cwt. in 1890 to 2134 cwt. in 1891, and 3465 cwt. last year. The quantity of coal carbonized in 1890 was 6170 tons; in 1891, 6550 tons; and in the past year, 7538 tons. The quantity of gas produced per ton of coal was 9250 feet in 1890, 9872 feet in 1891, and 9850 feet in the past year. The cost of carbonizing per ton of coal was 3s. 8d. in 1890, 3s. 3d. in 1891, and 3s. 1½d. in 1892. The report, which was considered by the members to be a very satisfactory one, was unanimously adopted.

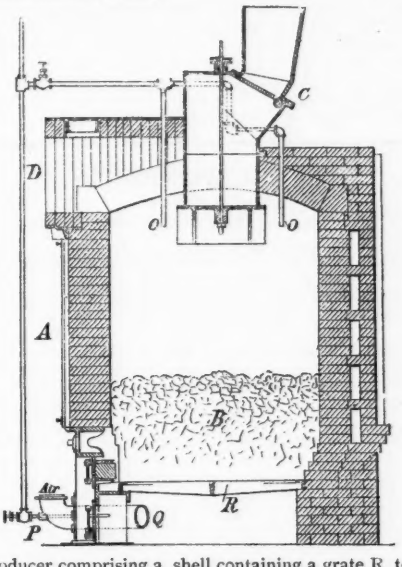
REGISTER OF PATENTS.

Manufacture of Fuel Gas.—Boult, A. J.; communicated from the Chicago Heat Storeage Company. No. 3995; March 1, 1892.

This invention relates to the manufacture of fuel gas from coal in a so-called "producer," wherein, according to the generally stated common practice, a coal fire is built on a grate and, when raised to the condition of incandescence, a fresh supply of coal is deposited upon it; and this is repeated whenever that preceding it has, by combustion, been raised to incandescence—the necessary supply of air being meantime passed through the bed of fuel, either in an upward, downward, or other direction.

In the manufacture of producer gas as thus outlined, say the patentees, the great heat to which each fresh deposit of coal is subjected by dumping it upon the incandescent bed in the producer, necessarily induces a sudden distillation of hydrocarbon vapours contained in the deposited coal, which vapours escape from the producer before they have had time to be thoroughly gasified, and are thus, in a great measure, wasted. Furthermore, so much of the resulting gaseous product attains a temperature so high as to tend to destroy, by its intense heat, the metal parts—such as the coal distributor of the producer and the conduit through which the gas is passed to the point of its utilization or storeage.

The object of this invention is to provide a proceeding whereby this waste is prevented; and whereby, also, fixed producer gas, with exceptionally high heating capacity, shall be produced, having a temperature so much lower than that of ordinary producer gas as to materially reduce its destructive tendency.



A is a producer comprising a shell containing a grate R to support the fuel B, and below which the supply of air enters through a conduit Q; a steam-injector P being provided as an air-forcing medium. At the top of the producer, is a hopper-device C, by means of which to supply coal to the producer. At opposite sides of the hopper are provided steam-pipes O, of small bore, communicating with a steam supply (not shown). D is the outlet-flue for the gas.

The operation is as follows: The bed of fuel B is blasted with air from the pipe Q; the air-blast being continued throughout the operation of the producer. Also the steam-supply may be used as the air-forcing medium; but it is preferably employed whether so used or not, as it very materially increases the heating capacity of the producer-gas product. On the initial bed of fuel, after it has been raised throughout to incandescence (though it may be before), steam from the pipes O is admitted to impinge against the top of the bed, thereby cooling that portion of it, and causing the formation on the surface-portion of the bed of an ash-incrustation or coating. This materially reduces the conductivity of the bed-surface, and, consequently, its power of conduction and radiation; so that when a fresh supply of coal is deposited upon it from the hopper, it will not be subjected suddenly to a heat so intense as to generate and produce sudden distillation of the hydrocarbon vapours therefrom. On the contrary, it tends more gradually to heat and effect disintegration of the lumps forming the fresh deposit, thereby so gradually to raise the temperature of the latter and distil therefrom the vapours, as to adapt them to be gasified before they can escape from the producer. At the same time the temperature in the producer is so modified by the injected steam, and by the cooler surface afforded by the ash-coating on the upper portion of the incandescent mass, that it reduces the liability of injury to the apparatus, and tends to so graduate the conversion of the combustion products as to reduce them to a fixed gas having comparatively moderate temperature.

The foregoing, involving the impingement of steam against the surface of the initial bed of fuel, forms by preference the first or preparatory part of the process. The continuation of the process involves the supplying, at intervals, of fresh deposits of coal, each of which requires, as the essential treatment for the purpose, that steam be impinged against it before it is heated to incandescence, since if so impinged after it has attained incandescence, the action of the steam would be on the incandescent fixed carbon of the coal only; because, by the time the coal is in the highly incandescent state, the volatile matter has all been released, and it is an especial object of this invention to act upon the volatile matter contained in the coal.

As will be apparent, the patentees remark, the steam absorbs heat from the surface of the fuel bed during its own decomposition, which

is produced by the fuel while burning; since, as is well known, steam, while being reduced to its elements, hydrogen and oxygen, absorbs as much as the same element will again give off on combustion. Thus the oxygen of the steam unites with the carbon of the surface coal as the latter becomes heated by the incandescent mass below it, leaving a surface-ash which is non-conductive of heat. Consequently each fresh charge of coal dumped upon the surface of the bed, finds such surface comparatively cool; and it is, furthermore, separated from the incandescent mass by a light layer of ash. The direct effect of this contact, and of the steamed condition of the deposit, is that the disintegration of the lumps of deposited coal, and the distillation of the volatile hydrocarbon contained therein, are produced in a sufficiently slow manner to enable thorough gasification of the volatile hydrocarbon to be accomplished as the result of the introduction of the steam.

Igniting-Tubes for Gas-Motors.—Shillito, T. R.; communicated from J. M. Grob, A. O. Schultze, and A. V. Niemczik, of Eutritzsch-Leipzig, Germany. No. 8821; May 25, 1891.

In the course of their specification, the patentees say that for years the igniting-tube used in gas-motors has been heated from the outside by a flame, and kept at a very high temperature. It is closed at its outer end, and by its other end is in open communication with the interior of the combustion chamber; or it may be alternately separated from, and placed in communication with, the combustion chamber by a slide, valve, or any other working organ. When the compression of the combustible gaseous mixture takes place, some of it is forced into the tube, and is ignited by the heated surface at the moment the piston reaches the inner end of its stroke. Tubes for this purpose have been made of various metals; but hitherto they have been found to burn away in a short time, or become coated over, or corroded inside, so as to prevent the combustible gaseous mixture from coming in direct contact with the heated surface of the tube. Other materials—such as porcelain or stone—are very liable to fracture. The object, therefore, of this invention is the manufacture of igniting-tubes from "a metallic alloy" of copper and aluminium in the proportion, by preference, of 95 per cent. of copper and 5 per cent. of aluminium.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

The Return to the Eight-Hour System at the Rotherhithe Works.

SIR,—To prevent any mistake about the change from the eleven to the eight hour system at our Rotherhithe station, referred to in the JOURNAL last week, I shall feel much obliged if you will publish this letter.

Immediately after the strike, the men at some of our stations agreed voluntarily to work on the old system of eleven-hour shifts, while at other stations they preferred the eight-hour shifts; and so they have continued to work—the pay in both cases being in exact proportion to the work done. The men do about 20 per cent. more work in eleven than in eight hours, and receive about 20 per cent. more pay.

The work is very irregular; about three times the number of men being required in the winter. Consequently, although work other than stoking is found for as many as possible, a very large proportion have to leave in the summer. Moreover, at that time, owing to the heat of the weather, the work causes a certain amount of distress to the stokers. It therefore occurred to me some months ago that a reduction of hours in the four or five summer months would relieve the men, and at the same time enable the Company to give continuous employment to a greater number of the winter hands. Beyond this, it would allow the men more leisure at the time of year when it would be most pleasant and useful to them, and the Company would retain in its service a larger proportion of expert stokers The Rotherhithe men were therefore asked last week to make their choice—the voting to be by ballot; and, by a large majority, they decided to take the shortened hours of work, coupled with the lower pay, during the summer, and to return to the eleven-hour shifts and higher pay when the winter approaches. I may add that there was not the slightest action on the part of the men; they made no request for any alteration. There was no agitation whatever; and they seem to have accepted the offer as a boon.

GEORGE LIVESEY.

May 19, 1892.

Mr. Hunt's Presidential Address.

SIR,—I am very unwilling to trouble you; but in the course of your indulgent criticism of my address, it is suggested that there is "something like a 'bull' in the presidential argument that if the local authorities get for 4d. per 1000 cubic feet of gas sold something which costs the companies 7d., the difference in favour of the former is probably about 5d. per 1000 cubic feet of gas sold."

Will you allow me to point out that what I did say was that "for every 7d. that it costs the companies for dividend and interest, it only costs the local authorities 4d. for interest charges;" the respective rates of interest being taken as 7 and 4 per cent. Assuming, then, that 1s. per 1000 cubic feet of gas sold fairly represents the average cost to the former, the average cost to the local authorities would be $\frac{1s. \times 4}{7}$ = 7d. nearly; or, as stated by me, about 5d. per 1000 cubic feet of gas sold, in their favour.

There is one other matter to which, with your permission, I should like to refer. I am credited with having ascribed to Mr. George Livesey the origin of the phrase "decremental rate of increase." This is a mistake. I have no concern with the origin of it. I but referred to it as having been adopted by Mr. Livesey to describe his proposed modification of the sliding scale. Let me refer to your own report on this subject. Speaking at Glasgow upon a proposal to reduce the standard scale, "Mr. Livesey" (see JOURNAL, May 19, 1887, p. 169) "suggested it should be called a decremental rate of increase." Farther on in the same report (p. 170), he says: "Let the gas companies, instead of taking 5s. per cent. for every penny reduction after a reasonable point has been reached, take only 2s. 6d. per cent. for every 1d.; and this was what he meant by a decremental rate of increase. This term was used in the great Birmingham arbitration case by an eminent statistician; and it was undoubtedly quite right, although it puzzled the opposition Counsel, Mr. Matthews, who described it as 'arithmetic gone mad;' for the increase might be 10 per cent. this year, 9 per cent. next year, then 8, 7, and 6. That was truly expressed by the term 'decremental rate of increase.' It was a proper expression; and he should say let the sliding scale go on, but adopt the principle of a decremental rate of increase of dividend in cases where the dividend per 1000 feet is excessive."

It will be seen from this quotation whether or not my reference to the phrase was accurate; and also whether Mr. Livesey is to be regarded as having been in earnest in adopting it, as I maintain, or simply amused at it, as you suggest.

CHAS. HUNT.

Birmingham, May 20, 1892.

SIR,—Referring to your "Review of the Proceedings" at the recent general meeting of the Incorporated Institution of Gas Engineers in last week's issue of the JOURNAL, if there be "fearful joy" on the part of an Editor "in correcting a President in the matter of reference or quotation," you will readily appreciate the *ecstasy* of a reader when an opportunity is afforded for correcting an Editor on the same score; and this is what I venture to do.

First of all, I would remind you that Birmingham did not purchase the gas undertakings of the two Companies by arbitration, but by Bill; and that Sir Edmund Beckett was engaged as leading Counsel for the Corporation in connection with their Bill in both Houses of Parliament. But he took no part whatever in the subsequent West Bromwich arbitration. The late Mr. W. H. Michael, Q.C., was chief Counsel for the Corporation in these proceedings, in which I took a prominent part throughout; and the words "decremental rate of increase" emanated from Mr. Price-Williams, M.Inst.C.E., one of the experts engaged in the case. Those who have copies of the evidence in that arbitration will find the words in the note to Mr. Price-Williams's table on page 272, as follows: "The population of West Bromwich is assumed to increase at the average *decremental rate of increase* which obtained during the last four decades"—the table showing that the rate of increase, 3·53 in the year 1878, would gradually fall to 1·79 in 1902.

I well remember that the able tables and diagrams, through not being understood, caused at first some little confusion and amusement; and it was Mr. Matthews, the present Home Secretary, who was chief Counsel for the West Bromwich authorities, and not Sir Edmund Beckett, who was the author of the words "arithmetic run mad" in relation to the noted phrase. He made use of them in his lengthy and able address to the Arbitrators, when referring to the possible effect of the neighbouring mines upon the profits of the Swan Village works. He said (p. 681 of the proceedings): "I confess it is a difficult question to answer; but I would say even Mr. Price-Williams, with all his diagrams and tables, I do not suppose would be able to show the possible *decrement* of value in a work that any moment may find itself at the bottom of an excavation. I would like to see how he would compound the '*progressive decrement of a possible increment*' to represent that chance—even '*arithmetic run mad*' I think could not arrive at the proper figure for that!"

HENRY HACK.

Saltley, Birmingham, May 20, 1892.

[This matter has been mentioned in our editorial columns to-day.—ED. J. G. L.]

Sale of Shares.—Messrs. Suddards and Stansfield offered for sale by auction yesterday week, at Bradford, stocks and shares to a large value in local companies. The following prices were obtained: £75 of stock in the *Gildersome Gas Company* sold for £120; £300 of 7 per cent. stock in the *Shipley Gas Company* realized £158 per cent.; £140 of "A" stock in the *Harrogate Gaslight Company* produced £322 10s.; £1000 of "B" stock in the same Company yielded £267 and £268 per cent.; £200 of "C" stock sold for £250 per cent.; £2440 of stock in the *Pudsey Gas Company* realized from £186 to £191 10s.; 87½ £10 "A" shares in the *Eccleshill Gas Company* produced £17 10s. and £18 each; 38½ £8 "B" shares yielded £13 17s. 6d. and £14; and 14 £7 "C" shares sold for £12 10s. each.

Exeter and the Electric Light.—A special meeting of the Exeter City Council was held last Wednesday for the purpose of considering a report by the Surveyor on the lighting of the streets by electricity. It stated that, in the area proposed to be lighted, there were, exclusive of side streets, 136 gas-lamps, of which 82 could be dispensed with if electric lighting was resorted to; and their annual cost was £724 11s. To light the area by electricity according to a plan produced would require 56 arc lamps of 1200-candle power each. For simply lighting the main streets and open spaces, only 32 arc lamps would be required. The estimated first cost would be £1680 for 56, and £960 for 32 lamps. A tender had been obtained from the Electric Light Company, who agreed to supply the light for £22 10s. per lamp per annum, the Council providing lamps, posts, brackets, and globes; or for £24 per annum if the Company provided the lamps and globes. For the larger scheme the annual cost would be £1377 12s., against £724 11s. at present paid for gas; and for the smaller scheme £768, against £517 7s. 4d. The Surveyor said he did not see much prospect of a reduction in the cost of electric lighting; but he thought before long communities would adopt it, even at the increased cost over gas. If the posts now used for carrying the wires were accepted for the lamps, the first cost of installing the new light would be considerably reduced. That an increase in the illumination of the main thoroughfares was desirable was, he thought, admitted; and whether the streets were lighted by gas or electricity, there was evidently a demand for more light. Replying to Mr. H. F. Willey, the Town Clerk stated that he had not yet had any estimate from the Gas Company for supplying larger lamps for the leading thoroughfares; and, after some discussion, it was decided to further consider the report on the 8th prox., by which time it is expected an estimate will be received from the Company.

EXTRACT FROM LETTER TO

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HOUSE OF LORDS.

Monday, May 16.

WATER COMPANIES (REGULATION OF POWERS) BILL.

The EARL of CAMPERDOWN, in moving the second reading of this Bill, said that, with one or two exceptions, it was identical with the measure which passed through that House in 1885, but which was lost in the other House owing to the pressure of business. The Bill had two main objects. The first was to impose upon all companies supplying water at a profit an obligation to send to every consumer a demand-note containing the particulars of the charges made; and the second was to compel the companies, where disputes arose as to the legality of the charges, to abstain from cutting off the water until a decision in their favour of a Court of Summary Jurisdiction had been obtained. As the law stood at present, the consumers were bound to pay the water companies a quarter's rate in advance on the first day of each quarter, without any particulars of the quarter's charge being given; and if such payment were not made, the companies were entitled the next day to cut off the supply. Such a state of the law had given rise to great abuses, as had been proved before a Select Committee of that House some years ago. By clause 4 of the present measure, the companies were required to send to each consumer a demand-note, containing the particulars of the charge, and the consumers were to be allowed 21 days to consider whether they would dispute any of the items of the charge. If within that time they gave the companies notice of their intention to dispute any of the items, the companies were not to be allowed to settle the matter by cutting off the supply until after they had obtained a decision of a Court of Summary Jurisdiction in their favour, and had subsequently to such decision given 14 days' notice to the consumers of their intention to cease the supply. In cases where the consumers did not dispute the items of the charge, the companies were required to give 14 days' notice before they could cut off the supply. The provisions of the Bill would apply in cases where water was supplied to a consumer for both trade and domestic purposes, where the charge for domestic purposes exceeded that for trade purposes; but they would not apply where the charge for trade purposes exceeded that for domestic purposes. By clause 11 the water companies were required to give notice to the local sanitary authority in all cases in which they cut off the supply.

The Bill was read a second time.

Friday, May 20.

WATER COMPANIES (REGULATION OF POWERS) BILL.

To-day the House went into Committee on this Bill.

Clauses 1 and 2 were agreed to.

The EARL of WEMYSS, who had given notice of his intention to move an amendment to clause 3, which would have the effect of bringing municipal corporations within the provisions of the Bill, intimated that he did not intend to press his amendment then, but reserved his right to move it at a subsequent stage of the measure.

Lord HERSCHELL inquired of the noble Earl who had charge of the Bill why it was that the measure was not so framed as to include municipal corporations.

The EARL of CAMPERDOWN said the reason was because they were publicly-elected bodies who were responsible to the ratepayers, who were the consumers of the water, for their actions, and who, if they cut off the water supply improperly, would be answerable to their constituents. Moreover, corporations had no personal interest in supplying water, and derived no profit from its sale; and therefore it was improbable that they would improperly cut it off as private companies were likely to do. No complaints had been made against corporations in this respect; but if they should hereafter act improperly, it would be easy to pass a short Act bringing them within the provisions of the present Bill. He gave his noble friend (Earl Wemyss) notice that, if he should attempt to move his amendment at a later stage of the Bill, he should oppose it.

The EARL of KIMBERLEY remarked that, in his opinion, corporations supplying water should be placed on the same footing as companies.

The clause was agreed to.

On clause 4,

The EARL of CAMPERDOWN moved an amendment excepting from the operation of the clause cases in which water was supplied solely by agreement or by meter.

The amendment was agreed to.

The EARL of WEMYSS said the water companies quite admitted that the details of the charge should be fully stated in the demand-note. He then moved an amendment to the effect that the period during which the consumer would be entitled to object to the particulars of the charge accompanying the note should be reduced from 21 to 7 days.

The EARL of CAMPERDOWN said the point had been carefully considered by the Select Committee to which he had referred on the occasion of the second reading of the Bill; but he would be prepared to go below the limit fixed by the Committee, and reduce the period from 21 to 14 days, if the noble Earl would accept this proposal.

The EARL of WEMYSS assented, and the reduction from 21 to 14 days was agreed to.

The clause, as amended, was passed.

The remaining clauses were agreed to, and the Bill passed through Committee.

The following progress was made with Bills last week:—

Bill read the first time: Bournemouth Improvement Bill.

Bills read a second time: Blackburn Corporation Bill; Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3); Gas Orders Confirmation Bill; Lanarkshire (Middle Ward District) Water Bill; Rhyl District Water Bill; Rhyl Improvement Bill; Water Companies (Regulation of Powers) Bill; Water Orders Confirmation Bill.

Bills reported: Mold Water Bill; North Shields Water Bill [preamble not proved]; Ormskirk Gas Bill; Southend Gas Bill.

Bill read the third time and passed: Uttoxeter Water Bill.

Bills Royal Assented: Barrow-in-Furness Corporation Water Bill Bristol Gas Bill; Liverpool United Gas Bill; Oxford Gas Bill Southborough Local Board Gas Bill.

HOUSE OF COMMONS.

Tuesday, May 17.

THE TAXATION OF SULPHATE OF AMMONIA STILLS.

Sir H. ROSCOE asked the Chancellor of the Exchequer whether he was aware that several prosecutions had been and were being conducted by the Inland Revenue against gas companies, especially that in Sunderland, and against certain manufacturers of the products of coal gas, for infringing an Act passed in 1846 (9 & 10 Vict., cap. 90), making it compulsory for every person keeping a "still" to take out a licence for it, and pay a duty of 10s. per annum, and in default a penalty not exceeding £50; whether stills for the manufacture of gas products had been in use for upwards of 30 years without any attempt to tax them; whether such stills come under the Revenue Act for the prevention of the manufacture of spirits by unlicensed persons; and whether, if the Inland Revenue wished to tax a piece of apparatus which was not used for distilling spirit, he would direct the preparation of an Act of Parliament for the special purpose, instead of permitting an old Act to be used in such cases.

The CHANCELLOR of the EXCHEQUER: There has been a prosecution against the Sunderland Gas Company at the instance of the Commissioners of Inland Revenue for the recovery of the penalty of £50 imposed by the Act 9 & 10 Vict., cap. 90, for keeping a still without a licence. The prosecution was heard on the 6th inst., and dismissed [see *ante*, p. 855]; and a special case is to be stated for the opinion of the Queen's Bench Division, as to whether the still used by the Company is one for the keeping of which a licence is required under the Act. In the opinion of the Board of Inland Revenue, these stills are capable of being used for the production of spirit; but, as the matter is still *sub judice*, I will not express any opinion upon it.

The following progress was made with Bills last week:—

Bills read the first time: Bexhill Water and Gas Bill; Uttoxeter Water Bill.

Bill read a second time: Ipswich Corporation Bill.

Bills read a second time and committed: Glasgow Corporation Water Bill; Swansea Corporation Water Bill; Swinton and Pendlebury Local Board Bill.

Additional Bills referred to the Select Committee consisting of Sir J. Pease (Chairman), Lord F. Hervey, Mr. W. M'Arthur, and Mr. Victor Cavendish: Glasgow Corporation Water Bill; Pontypridd Water Bill; Swansea Corporation Water Bill; Swinton and Pendlebury Local Board Bill.

Bills reported: Bradford Corporation Water Bill; Exmouth and District Water Bill; Gas Provisional Orders Bill [Orders confirmed]; Kilmarnock Corporation Water Bill; Middlesbrough Corporation Bill; Tredegar Local Board Water Bill.

Bills read the third time and passed: Cleator Moor Local Board Gas Bill; Liverpool United Gas Bill; Southborough Local Board Gas Bill.

Petitions against the following Bills were presented:

Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill, from the County Council of the West Riding of Yorkshire.

Gas Provisional Orders Bill (Sutton and Hooton Order), from Ratepayers of Great Sutton.

Glasgow Corporation Water Bill, from Magistrates and Police Commissioners of Partick.

Pontypridd Water Bill, from the Ystradyfodwg Local Board [against alterations].

Swinton and Pendlebury Local Board Bill, from the Corporation of Salford and the Little Hulton Local Board.

Western Valleys (Mon.) Water (Gas Purchase) Bill, from the Blackwood Gas and Water Company and the Risca Local Board.

HOUSE OF COMMONS COMMITTEE.

Thursday, April 7.

(*Before Mr.* CAMPBELL-BANNERMAN, *Chairman; Sir* W. HOULDSWORTH, *Sir* H. STAFFORD NORTHCOTE, *Mr.* R. K. CAUSTON, *Mr.* S. GEDGE, *Mr.* P. STANHOPE, *Mr.* POWELL WILLIAMS, *Mr.* W. JAMES, *and Mr.* E. H. LLEWELLYN.)

BIRMINGHAM CORPORATION WATER BILL.

The proceedings on this Bill (see *ante*, p. 852) were continued to-day. Owing, however, to concessions made by the promoters, Counsel representing the Wye Fisheries Board and the Commons Preservation Society were relieved of attendance.

Mr. *Howard Smith* was called to give the result of certain calculations he had been requested to make. He said the population of the water area in 1955 had been estimated on several hypotheses. It was now 648,000. If it rose at the same rate as the consumption of the water had been estimated to grow, it would then be 2,880,000.

The *Mayor* (Mr. Lawley Parker), recalled, stated that the rateable value of the borough was over £2,000,000; and the present debt £9,960,000, of which only £1,561,000 was unremunerative. He did not think the scheme would be at all prejudicial to the holders of Corporation stock.

Mr. POPE observed that, on the previous day, one or two members of the Committee had been anxious to be accurately informed about the quantity of water left for other communities, supposing Birmingham were entrusted with the powers asked for. He desired that this question should be absolutely understood; and therefore, with their permission, he would recall Mr. Mansergh.

Mr. *Mansergh*, recalled, and examined by Mr. POPE, said that, in the districts adjacent to that proposed to be appropriated, there would be

left, at a sufficient elevation for the supply of London, an area with water enough for the supply of 20 million people. The Elan and Claerwen alone would not be sufficient for London. Their watershed, in consequence of its elevation, was almost the only portion of Wales available for Birmingham, and was certainly the most suitable; whereas London would have the choice of lower elevations. In regard to the Wye, the agreement arrived at with the Conservators was that 27 instead of 22 million gallons should be sent down daily. Manchester retained her former sources of supply after acquiring Thirlmere; but in Birmingham the present sources would be abandoned, because it was useless to continue the cost of pumping, especially when the water in the wells was deteriorating. Glasgow took 100 million gallons of water a day, with no obligation to supply anybody on the road.

Mr. *T. Hawksley*, F.R.S., said he regarded Mr. Mansergh's scheme as a noble and comprehensive one. It was not too large, considered in regard to the probable future requirements either of Birmingham on the one hand or of London on the other. In estimating any increase in water consumption, it was necessary to look forward not only to the growth of population, but to larger individual wants. One was quite as important a factor as the other. As to dual systems of supply, the chief objection to them was that they were irrational. One might put in two pipes; but one could not make them be used for their special purposes.

Mr. *G. H. Hill*, M.Inst.C.E., Joint Engineer with the late Mr. Bateman for the Thirlmere works of the Manchester Corporation, said Mr. Mansergh's scheme for Birmingham was a very good one, and not in the least excessive. In the case of the Glasgow works, completed 32 years ago, it was thought they would be sufficient for a hundred years; and yet he had lived to see a second aqueduct made to bring 60 million gallons a day more to the city. To suggest a dual supply was, to his mind, ridiculous.

Mr. *J. M. Gale*, M.Inst.C.E., Engineer of the Glasgow water scheme, expressed similar opinions.

Mr. POPE intimated that he had Sir Frederick Bramwell, Mr. Heap, of Sheffield, and other engineers, ready to give evidence; but he did not think it necessary to call them.

The CHAIRMAN acquiesced.

Mr. *S. Williams*, County Surveyor of Radnor, then gave evidence in reference to the common rights exercised within the area proposed to be taken; and with his cross-examination the proceedings closed for the day.

Friday, April 8.

This morning, Mr. *Williams* was further cross-examined.

Mr. POPE having read certain clauses which had been drafted to safeguard the rights of the commoners,

Witness, in answer to questions by the CHAIRMAN, said he did not think the people of the district affected, who were sufficiently intelligent to appreciate the benefits to be derived from the scheme, viewed it with the slightest hostility. He believed, on the contrary, that they were looking upon it as one of the greatest benefits which could possibly have happened to a poor neighbourhood. Many of the sheep farmers had been afraid of their sheep-runs being taken from them, and of the Corporation proving a less agreeable landlord than their present ones. The working classes, however, were strongly in favour of the Bill, because the scheme would provide them with work at their own doors for eight or nine years. As to the community living round Rhayader, he was perfectly satisfied that their feeling ran so strongly for the Bill, now that the Corporation had conceded the clauses just read, that, if necessary, they would petition in its favour.

Dr. *A. Hill*, Medical Officer of Health for Birmingham, corroborated the evidence of the previous witnesses as to the immediate necessity for an additional supply of water for Birmingham; and he bore testimony to the excellence of the proposed source.

In cross-examination, witness said the sudden change from hard to soft water would not be inimical to the public health. He had made two analyses of the Welsh water—once after rain, and the other in fine weather, and both had shown it to possess all the qualities which it was desirable to combine in a town supply.

Mr. *Gray* was recalled to answer a few questions put by the CHAIRMAN; and the promoters' case closed.

Mr. PEMBER then addressed the Committee on behalf of the London County Council. He said his clients did not think it necessary to support their position with witnesses, because all they cared to do was to make such comment upon the evidence of the promoters as might strengthen the contention with which alone they were concerned—viz., that the Committee ought to be perfectly satisfied of the pressing necessity of Birmingham before they passed the Bill. The London County Council did not approach this matter in any unfriendly or carping spirit. On the contrary, they would naturally, *primâ facie*, have sympathy with a great Corporation doing what they were inclined to think that, some day or other, they would have to do themselves. But they did feel that, under present circumstances, it was needful to emphasize the possibility of their having to go into some such neighbourhood as that of the Elan and Claerwen, and to ask the Committee to consider very carefully the exact circumstances of this measure, the mode of its introduction, and the relation it bore to the Royal Commission on Water Supply which was now sitting, and to the stage at which the question of the London Water Supply had arrived. Their petition submitted that the Elan and Claerwen were well known as one of the possible future sources of supply for the Metropolis, and that no such appropriation of their waters as the Bill proposed should be authorized until the Commission had made its report. There was a certain similarity between the positions of London and Birmingham as to their respective water supplies. Both seemed to have sufficient water for their present requirements. Birmingham had a surplus of 3 million gallons a day; and probably London had something proportionate. He thought he might say, also, having read Mr. Gray's report, and knowing what he did of London, that both cities could increase their present quantity. Both had equal claims to go to Wales; neither had any inherent or domestic claim to the waters of the Principality. If there were to be urged on behalf of either a scintilla of prior right accruing from early projects of appropriation, perhaps it might be urged on behalf of London; for if Sir Robert Rawlinson reported in 1871 that the district of the Elan and Claerwen was worthy of consideration by Birmingham, it was also true that Mr. Fulton reported four or five years previously upon a similar project for London on a still larger scale. But the future needs of Birmingham paled in importance before the future needs of London. He never heard anybody suggest that London was increasing, in respect of either population or water consumption, at a slower rate than the other great towns of England; and, as a matter of fact, he believed that it was increasing more rapidly than they. The present consumption of water in London was, as nearly as possible, 180 million gallons a day; and the population within the area of supply was 5¼ million people. Apply anything like the Birmingham calculations to these figures, and the most remarkable results appeared. By the time Birmingham would consume its 30 million gallons of water a day, London would consume 360 millions; and if it was right that the supply of Birmingham in 1955 should be 67 million gallons, that of London ought to be 804 millions. He was not concerned to say whether or not he trusted these calculations. It might well be that they led to an absurdity in the one case as in the other. But if the promoters looked at the thing in the right way, and if the problem of the next 60 years was difficult and pressing for Birmingham, as they said it was, what must be the difficulty surrounding the problem of the London supply, what must be the need of dealing with that problem immediately? The learned Counsel then proceeded to deal with the figures contained in Mr. Mansergh's table to disprove the urgency of the scheme. Birmingham had, he said, a consumption estimated for this year, of 17½ million gallons a day. He noted that 15¼ millions was the first figure in Mr. Mansergh's table; but he passed by this discrepancy, because, at all events, there was a daily surplus of 3 million gallons. Mr. Gray's scheme would carry the consumers on for 20 years, at the end of which time their consumption would be 30 million gallons a day, as shown by Mr. Mansergh's table. It was quite clear, then, that Birmingham could do without any water at all from Wales for this period. This was the usual time for which water engineers were in the habit of looking forward, not for small towns, as had been suggested, but for places like Oldham and Halifax. But, on the showing of the promoters themselves, in 1955, when their supply would amount to 67 million gallons a day, they would need only 37 millions.

Mr. BALFOUR BROWNE: It is 62 millions now, because of the concession we have made to the Wye Fisheries Board.

Mr. PEMBER said he was willing to admit the qualification; but even then the scheme was positively twice too big. That 37 million gallons of estimated supply was only 8 millions in excess of what would be provided by the first instalment of the works. If this part of Wales were to be used at all on a large scale, and London wished to go there, was it not clear that, in case there should be a surplus over and above the needs of London, an arrangement could easily be made by Parliament by which Birmingham could take such a share of it as would represent her real needs at any time covered by the term of Mr. Mansergh's table? If upon the figures in this table the scheme was shown to be twice as large as was needful, how much too big did it appear on a common-sense basis?

The CHAIRMAN: Have you carefully considered the possibility of Wolverhampton and of other large towns within the 15-mile limit pulling at the same cow?

Mr. PEMBER replied that Mr. Mansergh had expressly stated that he wanted the 67 millions for Birmingham and the district; and the Committee had had no evidence from Wolverhampton or any other large town of its desire to take part of this Birmingham water. If there had been such evidence forthcoming, Birmingham would not have failed to produce it.

Mr. STANHOPE pointed out that the South Staffordshire Water Company had not raised any opposition to the scheme.

Mr. PEMBER said that if they desired any of the water they would have been expected to appear in support of the scheme. As to the goodness of the present supply, Dr. Frankland only pledged himself that it was on the verge of being suspicious; and it was significant that this warning as to the quality of the water had come after the determination of the Corporation to go to Wales. He submitted, therefore, on the whole case, that there could be no harm in postponing the matter for two years.

Mr. CAUSTON asked if Mr. Pember had any suggestion to make for the protection of London by clauses.

Mr. PEMBER replied in the negative. He said his own belief was that it would be extremely difficult to frame any.

The CHAIRMAN concurred. London asked that provision should be made "which may not prejudice or affect any future scheme."

Mr. A. T. LAWRENCE then addressed the Committee on behalf of the Hereford Corporation; reaffirming the absolute property of that body in the waters of the Wye. He contended that Birmingham ought to let Hereford put into the aqueduct a main capable of abstracting 650,000 gallons of water a day.

The Committee adjourned until the 2nd inst.

LEGAL INTELLIGENCE.

STAFFORDSHIRE QUARTER SESSIONS.—Tuesday, May 17.

(*Before Mr.* T. F. TWEMLOW, *Chairman, and a Bench of Magistrates.*)

The Assessment of the Birmingham Corporation Gas-Mains.

The hearing of the appeal by the Birmingham Corporation against the assessment of their mains at Harborne by the Assessment Committee of the King's Norton Union was resumed to-day. A report of the first three days' proceedings appeared in the JOURNAL for April 26.

Mr. DANCKWERTS and Mr. KETTLE appeared for the appellants; Mr. YOUNG, Mr. PRITCHETT, and Mr. SHAKESPEARE for the respondents.

The CHAIRMAN, on taking his seat, intimated that the Bench were of opinion that there was no great rating principle involved in the case; and as previous cases had decided upon which items deductions might be made, there seemed to be no necessity for any technical lecture on

the principles of rating. It was very desirable that the case should not be unduly protracted; and they would suggest that Mr. Young should call witnesses without proceeding further with his address.

Mr. YOUNG said he would accept the suggestion of the Court.

Mr. *R. Clarke*, Surveyor to the parish of Birmingham, said that, taking the receipts from Harborne for 1889 at £4035, he estimated the rateable value at 15 per cent. on those receipts, *plus* rates at 5s. 3d. in the pound. The rateable value on that basis for the Harborne portion would be £475; but he thought £400 was a fair figure. This sum was equivalent to 9 per cent. on the receipts of £4529 in 1891.

Mr. *W. A. Mason* next presented his valuation, and explained on what points it disagreed with that of Mr. H. E. Jones. He said that if the Corporation had charged the maximum price of 4s. per 1000 cubic feet, as they were entitled to do, the net receipts, from the gas undertaking would have been £732,572 in 1890, instead of £435,149, the amount appearing on the printed balance-sheet. He differed from Mr. Jones in the matter of the £2105 profits from fittings, which he thought ought to be included in the receipts. Witness, amongst other items, then sought to reduce the appellants' figure of £322,401 for working expenditure, and instanced the charges made for the Secretary and clerical help. He said that, as the same officials were engaged in keeping the expenditure and capital account and the annuities account, he thought £2000 should be deducted as the expenditure of the hypothetical landlord.

Mr. DANCKWERTS remarked that the witness was theorizing on a matter about which a simple inquiry would have shown he was wrong. The landlord's work he spoke of was done in the Treasurer's office.

Witness (continuing) made deductions which brought Mr. Jones's figure for working capital from £322,401 to £248,628. Passing on to the question of tenant's chattels and working capital, he gave as his figure £250,000, as against the sum of £365,785 put in by Mr. Jones. Various items under this heading were dealt with by witness, who explained in detail where he differed from Mr. Jones as to what should be entered as tenant's capital and what should be put down as landlord's capital—upon which point arose the difference in the total sums. For instance, Mr. Jones claimed £51,000 as the total value of the standing stock of coals for 1890, on the ground that a six weeks' supply was necessary. On the other hand, witness pointed out that the books of the undertaking showed that during 1890 there was never more than £28,086 stock value; and he contended that no gas company kept a six weeks' supply. With reference to the renewal of meters, he could not understand why £11,280 should be required under that head, seeing that for 16¼ years the actual amount spent per annum on renewals was £7757. He gave £155,858 as the rateable value of the whole undertaking, as against £79,331 given by Mr. Jones; and he put the rateable value of the mains (*plus* rates) at £104,287, as against Mr. Jones's £27,760. If the appellants' figures were adopted, the undertaking would be insolvent, as the Committee would be £17,978 short of the money needed for annuities, Corporation stock, and bonds. On the basis of witness's calculations, the rateable value of the Harborne mains was £832. Summing up his evidence, Mr. Mason pointed out that his valuation of the works for 1890 was £39,644, and of the mains (less rates at 6s. in the pound), £80,266; or a total of £119,910. He found, taking a number of years, that the average annual profits of the undertaking were £153,343. The tenant's share of that would be £32,500; and the correct rateable value £120,843, as against his estimate of £119,910 for a particular year.

In cross-examination, witness admitted that he had in error deducted discounts from receipts which already had had the discounts deducted. The books were very confusing.

Mr. DANCKWERTS: What problem have you set yourself to solve in these calculations?

Witness: At what rent this undertaking might reasonably be let from year to year; the landlord paying the statutory repairs and the tenant maintaining the plant, chattels, &c.

But the rent ought to be what the tenant could reasonably afford to pay?—No; the rent that might be reasonably expected. One year the accounts might be made so as to show no profits, yet the undertaking might be valuable. My calculation has shown that the tenant paid 66 per cent. of the net receipts to the landlord.

Wednesday, May 18.

On the resumption of the proceedings this morning,

Mr. *Mason* was further cross-examined, with the object of showing that, starting the year with a capital of £253,077, the hypothetical tenant of the works had, on the witness's figures, at the close of the year only £190,000. He maintained that there was something fallacious in the argument of the learned Counsel; but, at the moment, he could not see where. He had treated the lamps as landlord's property. If, as was suggested, the Corporation supplied the lighting authorities outside the borough with lamps free of charge, they were treating the local authorities most liberally in selling their gas at not a farthing profit, and giving them lamps in addition.

Mr. DANCKWERTS: And, in return, you want to put up our rates?

Witness: Certainly, they ought to be put up; you make plenty out of the customers. Continuing, he said he adhered to his estimate of the tenant's allowance at 15 per cent. on fixed capital, and 10 per cent. on working capital. He contended that no special reserve fund was needed for the renewal and maintenance of meters. A renewal, in his opinion, was the replacement of something destroyed by ordinary wear and tear; and a repair was the replacement of something destroyed by accident. He also contested Mr. Jones's allowance of 40 years' life to gas-mains. He knew of a small works at Tewkesbury where they were 60 years old; and he had heard of them being 100 years old.

In re-examination, witness said that, striking out the fittings, and making other corrections in his figures, his valuation in Harborne was reduced from £832 to £812. Allowing for bankers' interest on overdraft, it came to a level £800—just double the amount of the assessment which the respondents were seeking to uphold.

Mr. *W. A. Valon* was next examined, and produced a valuation of the gas undertaking made on the published accounts of 1890. It generally corroborated that of Mr. Mason.

Witness having been partially cross-examined, the Court formally adjourned until June 11.

MISCELLANEOUS NEWS.

THE ROYAL COMMISSION ON LABOUR.

Friday, May 13.

(SECTION C.—*Present: The Right Hon.* A. J. MUNDELLA, M.P., *Chairman; the* DUKE OF DEVONSHIRE, *Mr.* M. AUSTIN, *Mr.* J. C. BOLTON, *Mr.* T. BURT, *Mr.* G. LIVESEY, *Mr.* H. TAIT, *and Mr.* E. TROW.)

Evidence on Behalf of the Gas Industry.

To-day the hearing of evidence in connection with the gas industry (see *ante*, p. 919) was continued.

Mr. *John Higgins*, a stoker in the South Metropolitan Gas-Works, was the first witness called. In reply to the CHAIRMAN, he stated that, before going to the South Metropolitan Company, he was employed at the Salford Gas-Works, and had been there about 16 years. He had also been a member of the Gas Workers' Union, though he took no part in its formation. When a strike occurred among the gas workers at Salford in December, 1889, he, with several fellow-workmen, proceeded to London; but before doing so, he telegraphed to Mr. Howard, the Chief Inspector of the South Metropolitan Company, and was told to come. When he arrived he was employed on much better terms than at Salford. He had 5s. 4d. a day, and now he was on a stoking-machine, and worked twelve hours a day (he formerly worked eight hours), getting 1s. 8d. extra. When he went to the South Metropolitan Company, there was a strike on; and he and his comrades were met at the railway station at Greenwich by a large number of the men, and were assaulted by them. The strikers threw bricks at them, and tried to induce them not to go into the works. In several instances they were successful. He, however, went in under the charge of the police; and when once in the works, he did not dare to come out again. Several of those who were inside did attempt to leave; but they were driven back. They were assaulted, thrown down, and one man had his head cut open. They lived inside the works for about seven weeks; and during that time they were supplied with food and lodging by the Company. After the strike, he brought an action against Mr. Ward for slander, and obtained a verdict for £200 damages; but no part of that sum had yet been paid to him. He did not bear the expenses of the action. He was not a member of the Gas Workers' Union; and he had no desire to be one. With regard to what Mr. Ward stated on the previous day about machinery, he approved of it. The machines worked better than the men could do by hand, and no stuff was wasted. They effected a saving of labour, and made the men's task much lighter. They would diminish the number of men employed; but in all other respects the invention was a good and useful one. He had worked the machines for twelve months; and they were doing very well; they were, in fact, the best he had seen, he had travelled all over Salford, Manchester, and other places. Reverting to the question of payment, he stated that, in addition to his wages, he now received a benefit out of the profits of the Company. He was entitled to a bonus; and in respect of this he had received close upon £7—£5 last year and £2 the previous year, for six months. This was a considerable addition to his wages. As regarded the effect produced by the workmen being interested in the profits of the Company, in making them more careful in the use of material, and in improving their habits, as far as he and his fellow-workmen were concerned, they were just about the same—they did not waste, and they exercised care.

Questioned by Mr. LIVESEY as to the basis of his action in the slander case, witness stated that the Company by whom he was employed informed him that, if he were willing to commence an action they would pay the expenses.

In answer to a question by Mr. AUSTIN as to his joining the Gas Workers' Union, witness said it was not the result of voluntary action; he was compelled. Unionists would not work with him while he remained a non-Unionist. As to his coming to London while a strike was going on, he stated that before he started for the Metropolis he heard there was to be a strike.

Mr. LIVESEY: But you knew it was on when you left Salford?

Witness: Yes.

Interrogated by Mr. TAIT, witness denied that the Executive of the Gas Workers' Union informed the men at Salford during the strike there that they had taken a wrong step. He also mentioned that, after he went to the South Metropolitan works, he was intimidated many times, and reported this to the Company.

Re-examined by the CHAIRMAN, witness repeated that he had never in Salford heard it said that the men there struck against the rules of the Union; and he added that the local Organizing Secretary asked the men to come out, and they did so at his request. He (witness) was now in a comfortable situation, and was prepared to continue there. He had learned a lesson concerning membership of the Union; it had caused him to break up a good home.

Mr. *W. Thorne*, General Secretary of the National Union of Gas Workers, examined by the CHAIRMAN, stated that the Union was formed in March, 1889. He proceeded to give particulars of the strike in Manchester and Salford, to which the previous witness had alluded. The cause of it, he said, was the Manchester Corporation not carrying out an agreement; and the Salford men simply came out in sympathy with the Manchester workers, as in Salford there was no grievance at all. He did not call out the Salford men; as a matter of fact, the Local Secretary did it. But he (witness) did not approve of it. He was in Nottingham at the time; and he went straight to Manchester and Salford and told the Local Secretary that the best thing to be done was to obtain an interview with the Salford and Manchester Corporations, and endeavour to arrange for the men returning to their work. An interview was had with the Salford Corporation; but they would not come to any arrangement, as they had men to take the places of those on strike. During the strike at the South Metropolitan Gas-Works, he (witness) was Secretary of the Union; but he did not know anything of that strike till he had been two or three days in Manchester on the occasion to which he had alluded. But the strike was not decided upon without the consent of the Union. It was authorized, though many of the delegates protested

against it. The grievance was caused by asking the men to sign a twelvemonth's agreement; which would have been very detrimental to them. They did not object to their wages, nor did they to the bonuses, if there had been no compulsion to sign a twelvemonth's agreement. Interrogated as to their disapproval of the agreement, witness said he thought anyone would admit that the engagement was objectionable, as he who accepted it would have no freedom afterwards, and might, during service under it, be compelled to do more work than had originally been stipulated for.

The CHAIRMAN: Is there no advantage, on the other hand, in a man being sure of a twelvemonth's labour on good terms?

Witness: There may be, perhaps, but to the detriment of others, A man who is silly enough to sign an agreement——

Do you think that is a fair term to apply to a man taking a twelvemonth's engagement?—I do think he would be silly in signing himself for a twelvemonth to any person. Continuing, witness said he was aware that some of the best-paid officials in England entered into engagements for more than a twelvemonth; but having better situations than gas stokers, that was a different thing.

If the gas worker is getting full wages, and a bonus in addition, is that not good?—It depends on the condition upon which the bonus is given.

Then the cause of the strike was the condition attached to the bonus—this condition being a twelvemonth's agreement, nothing else?—No.

In further examination, witness gave it as his opinion that the men employed by the South Metropolitan Gas Company did not now work upon so favourable terms as they had done. The greater portion of them worked twelve hours, and had an extra shilling a day for the additional four hours; and the system was one by which the Company obtained an advantage over the men. If the last witness was a driver on a machine, he would not dispute his statements; but so far as manual stoking was concerned, the men were not so well off. Neither would he dispute the last witness's statements as to what he had received under the bonus system. It might be as he had said; but he would not get so much now, he (witness) thought. According to the conditions attached to the bonus, the higher the price of gas, the lower the bonus. Being requested to tell the Commission something about the other principal strikes since the formation of the Union, witness described the Leeds strike as the next principal one, and attributed it to the Corporation not carrying out their agreement. The Union undoubtedly approved of that strike. The next was at the Bristol Gas-Works. It lasted two days, and was settled favourably to the men, who obtained their own terms. He added that, if he had his way, he would compel every man to join the Union.

The CHAIRMAN: How?

Witness: By moral suasion, at the onset.

But jeers and taunts and threats are not "moral suasion," are they?—I do not agree with that; but I say that every man should join the Union, though I do not say it is possible to accomplish this.

Are you aware that the best Unions in England have succeeded in accomplishing great things for their members, and for many non-members, by a reasonable, orderly course of conduct?—I admit that.

In further examination, witness admitted that it was natural that, his Union having been in existence only about three years, workers could only join it gradually, and sensible men would come into it by degrees—they would come into it only when they saw it was a properly conducted Union. Reminded that, in the case of the Manchester and Salford strikes, men were thrown out of work by staying in the Union, and asked if he thought that was the way to propagate Unionism, he still maintained that the workers' business was to join the Union. He said that, in his opinion, they would make more progress if they did so; while if one-half of them were organized and the other not, they were placed at a disadvantage, and one class was set over the other. Being requested to send in to the Commission a written statement of all the strikes that had taken place among gas workers since the formation of the Union, he promised to do so. He then went on to point out that, in cases of dispute, the Union now tried to have them settled by amicable agreement or by arbitration. Membership of the Union cost 2d. a week; and, in addition to that contribution, levies were made when necessary. The first levy was during the South Metropolitan strike. There was no levy at the time of the Manchester and Salford strike; at least, none was authorized.

Higgins was here recalled; and he affirmed that, before the commencement of the Salford strike, a levy of 5d. a week was made.

Witness declared that it was without the authority of the officials of the Union. He next proceeded to show that the Union had endeavoured to avoid conflicts between employers and employed. He first referred to a recent difference at the Bromley station of The Gaslight and Coke Company, through the Company not adhering to their arrangement with the men—the former insisting on having 80 instead of 76 retorts done. But the Union did not think it desirable that there should be a conflict; and the men were doing 80 retorts, though they signed for only 76. Next, there was an unfair treatment of the men at the Company's station at Beckton. Notwithstanding that a notice had been posted up, signed by the Resident Engineer, to the effect that the men would go to work on a certain day and receive 5s. 9d. per day for as many retorts as the machines might be found to be capable of doing, with a reasonable amount of rest for the men, after one machine had gone to be repaired and been returned, the men were required to work at the rate of 5s. 4d., without any explanation at all. He went to the Resident Engineer, and that officer said that, as at other places the men were getting 5s. 4d., he thought the men at his works were not justified in having more. In that case, if the Union chose, there would be a conflict. But they did not choose; they did not think it was desirable, although it was very hard on the men to submit, while the Company were really in a position to pay the 5s. 9d. agreed upon. If the men stuck out for the agreement, it would mean a strike throughout the whole of the works in London; for they could not strike at one station of the Company without doing so at the whole of them.

The CHAIRMAN suggested that this difference should be represented in writing by the witness to the head officers of the Company, and an offer made to submit the matter to arbitration.

Witness said he did not see why they should arbitrate when there was an agreement, and the Company did not depart from that agreement because of their poor circumstances.

The CHAIRMAN: They have not been very flourishing of late, have they? Has not their reserve fund almost disappeared? Am I right, Mr. Livesey?

Mr. LIVESEY: Yes.

Witness: Well, it is not because the men are not doing their work as well as before.

The CHAIRMAN: I am not saying that.

Witness proceeded to refer to other matters about which there was some dissatisfaction among workmen.

The CHAIRMAN inquired if the Union would not be a good deal stronger in the support of public opinion if they expressed their willingness to refer these questions to the Board of Conciliation.

Witness: When you get a blank denial, what is the good?

Have you made the offer?—No, I admit I have not. But when one gets a blank denial——

That is the more reason you should make the offer. Let an impartial Court decide, and these disputes might be settled. It would be well to try it.—I trust we shall have no cause. I hope The Gaslight and Coke Company will take the matter into consideration, and pay the men as they should.

If they do not, will you refer to the Board of Conciliation?—I may take your advice, now you have said what you have.

Supposing the South Metropolitan Company were to agree to amend their scheme so as to admit of proper notice—say, a month's—being given by the men, would this reconcile the Union entirely to their bonus system?—I do not know that they are not now reconciled.

But you objected, and still object, to the twelvemonth's agreement?—Yes.

Supposing that was modified, how would the South Metropolitan Gas Company stand then in your estimation? Would that not meet all your demands?—If the agreement was only a monthly one, the same as with other companies, I do not know.

A monthly agreement would entirely satisfy your requirements, would it not?—I do not think the Union would object; but it is a question whether it would satisfy the Company.

Witness was further examined to make it clear that a large number of industries had been affiliated to the Union. He said he did not see any objection to a Union which dealt mainly with gas workers governing a large number of other classes of workmen. The officials of the Union did not understand the details of the other trades; but any dispute among these was discussed at a District Council before reference to the officials; and they favoured the amalgamation because the gas workers found that, when they came out on strike, men in other trades were brought to fill their places, so it was better to organize and affiliate these. If the other trades would organize among themselves, it might be best that they should do so; but if there was no attempt at this, the Gas Workers' Union considered that they were justified in organizing them. Asked if he desired to express any opinion as to any subjects of legislation, witness requested to be allowed, before passing on to these, to explain the causes of one or two more strikes of gas workers. There was the one at Barnsley, which was caused by the Company compelling the men to go back again on the twelve-hour system. They kept this strike on about six months; but, unfortunately, the Company were in a position to defeat the men. They played one class of men against the other. They had their agents in Manchester, and got men from there to replace the former workmen.

The CHAIRMAN said the first error was the strike of the Manchester men, because this threw thousands of gas workers on the market.

Witness replied to this that, if the Manchester and Salford stokers had remained at work, those who took their places would have been walking about. He then went on to point out that similar occurrences took place in other towns; and he afterwards expressed the opinion that it was desirable that an eight-hour working day should be established by Act of Parliament. If this had been done in the past, the gas workers would not, he said, have come into conflict with employers so many times; they would have been thousands of pounds in pocket; and there would have been more men employed than at present. Very nearly the whole of the gas workers in London and the provinces were working an eight-hour day; and he thought it would be far better if this plan were legalized. He also sought to show that the idea entertained by many people, that the gas workers, in having their hours of labour reduced from twelve to eight, had the amount of their work correspondingly lessened, was not correct. The reduction of hours had not been attended with any great decrease in the quantity of labour; so that if the eight-hour day were fixed by statute, it would not mean a very large increase of men employed in gas-works. He recognized, he added, that the supply of gas was a monopoly; but his general observation was that, although there was an increase in the price of the labour producing it, its cost had not gone up throughout the country. He next directed attention to the Employers' Liability Act; saying he should like to see it altered. At present a claim under it had to be lodged within six weeks after the occurrence on which it was based; and sometimes the claimant was on a bed of sickness, and could not claim within this period, and so came outside the scope of the Act. The six weeks should be extended to at least twelve months. Then employers were at liberty to contract themselves out of the Act; and it was desirable that neither employers nor employed should be able to do this. In the matter of strikes, they had to complain of the interference of the police. During the South Metropolitan strike, he was knocked about by policemen; and many of their men were severely used, and the Union had to withdraw the pickets. They found that the policemen were really employed against the workmen, and for the benefit of the employers; and in such circumstances, he did not think the workmen had any chance of winning.

The CHAIRMAN asked the witness if he complained of men being protected in passing from a railway station to works where there was a strike.

Witness replied that he did. If men came to fill the places of others, they should do so without the assistance of the police.

The CHAIRMAN: Was it wrong for the police to protect the men from assault who came from Salford to the South Metropolitan works?—They were not assaulted.

Then the police did not interfere?—But the police marched them from the railway station to the works to guard them.

Why did the police require to guard them?—Oh, I do not know. I saw the crowd on the occasion; but it did not follow that the men would be molested. I maintain that the police should not protect any class of men for the benefit of employers.

Then you think the men were not entitled to protection?—I do.

Witness next reverted to the eight-hours question, and stated that, when Mr. Cunninghame Graham introduced his Eight-Hours Bill, a vote was taken among the members of the Union; and it was found that the whole of them were in favour of a Bill to make general this length of working day.

In reply to Mr. LIVESEY, witness admitted he had said at Plymouth, shortly after the agreement had been come to with the South Metropolitan Gas Company, that if they had to fight the battle with the Company again, knowing what he then knew, he would advise the men to leave without giving a week's notice. He knew what a serious thing it would be were the gas supply of a great city cut off, and admitted that the employees were responsible to the public. He was also aware that there was a special clause in the Conspiracy and Protection of Property Act, 1875, which inflicts a severe penalty on any person employed by a municipal authority or any contractor for the supply of gas or water who breaks his contract with his employer. Still, if he had known as much then as he knew now, he would have recommended the men to come out without fulfilling their engagements. It was better that a few men be imprisoned than such suffering should be entailed on hundreds of men and women. It would only entail misery on a few; and the others could support and keep their wives and children. With regard to the smaller strikes at Ponder's End and Bromley, he certainly did complain that the South Metropolitan Company sent men there for the purpose of defeating the ends of other men who were resisting the tyranny exercised over the men. He admitted it was natural that, it being generally known that a thousand stokers had left the South Metropolitan works, other people would apply to the Managers of that Company to give them the names of good men. But the effect would only be to starve another set of men in a different part of the country. It was only starving one man to give food to another. As to reducing the number of hours from twelve to eight, he admitted that it implied a reduction of one-third of the work; but it would be impossible for men in gas-works to stand continuous work as could be done in ordinary avocations. On some occasions, before he had been in the factory ten minutes, he had to rush out to get a breath of fresh air. At Bristol, on the occasion of a strike, there was an attempt to bring in new men; but this was successfully resisted by the Union. Cabs and vans were overturned; and the entrance was completely stopped up. The Bristol branch did not ask permission at the headquarters of the Union, but took the matter upon themselves. It did not come up for discussion at subsequent meetings of the Executive; so he could not say that the action of the Bristol people was countenanced.

In reply to Mr. AUSTIN, witness said he considered Unions which had no sick or out-of-work funds were the progressive Unions. He would not say that societies which had such funds were retrograde; but they were not, in his opinion, progressive. The Gas Workers' Union paid nothing but strike-money. On the question of the length of working day, notwithstanding what had been said by the painters, he believed an eight-hour day would be practicable in that trade, and in the carpenters' trade also. The officials might argue to the contrary; but the rank and file did not take the same view. As to the Manchester strike, he would say that if he had known as much at the time it occurred as he knew now, he would have advocated the employment of force. When the policemen and the military force were used against the workers, he considered the latter were justified in meeting force by force. He had admitted that there was no justification for that strike; but, as a worker, it was his duty to do the best possible for the workmen.

In reply to Mr. TAIT, witness stated that, immediately after the Manchester strike, Horrocks was deposed from his position as Organizing Secretary, in consequence of his action, which was considered to have been very ill-advised. Previous to the strike, he had told the Corporation that, if they would allow the men to withdraw their notices, he would use his influence to prevent any strike taking place; but the Corporation still continued importing men into Manchester to take the places of the others. If the Corporation had acceded to the request, the whole of the men would have gone back to work; and he did not think there would have been any more friction whatever. They would have worked with the six non-unionists, although one of them was a foreman. The cause of the strike had originally been a demand made upon the Corporation to have these six men removed; but they were, as the result of witness's action, prepared to give way on this point. Still the Mayor and the officials declined; saying that, as they had sufficient men, those who had struck must leave, and take their chance at the gate. After he returned to London, a report was made that Horrocks was squandering the money; and when the Executive heard this, they said that no money should go there until they had investigated the matter. They despatched people to Manchester; and in the result, they sent down about £250 or £300. This money was distributed among the men. A receipt was, of course, obtained from the District Secretary or the responsible officials; and then they would be responsible for the men getting the money. When the South Metropolitan gas strike was on, they learned that some of the Manchester men came to London to assist the Company. He had heard Mr. Higgins say he was a party to this. Although he was a member of the Union, he assisted in this way to defeat its objects. He left afterwards of his own accord; but if he had not done so, he would certainly have been expelled. Before he made the speech at Plymouth to which reference had been made, he had heard that the Company were employing strangers, in breach of the agreement they had made; but he could not absolutely say whether or not this was so. He did not altogether agree with Boards of Conciliation. Still he thought they might be of some use. He certainly considered that, as there was a law which punished workmen for intimidating one another, the intimidation of workmen by their employees should be stopped. When a strike occurred, he thought it was quite right to compel non-Unionists to organize; otherwise, they participated in the benefits without contributing. The masters employed whom they thought fit; and the men were equally entitled to say with whom they would work. If, in a gang of men, there were three Union men and one non-unionist, it stood to reason that those four could not possibly work together. There was friction; and consequently the work was not done so effectually as it would be if they were all Unionists. He thought that gas-works, the whole of the Government works, the mines, the railways, and monopolies generally, should first be brought under an eight-hour day. The police improperly interfered with picketing. At Vauxhall, a policeman followed him, trod on his heels, and gave him a punch in the ribs. If he had retaliated, he knew what the consequences would have been. He reported to the Inspector, who merely said that, if the man had done so, he had exceeded his instructions. When the men came up from Manchester to assist in the strike in London, he objected to the action of the police in preventing picketing. They told the men at the railway station to link arms; and in this way they all marched from the station. If these men could have heard the cause of the strike, he believed many of them would have returned. He went round to the Old Kent Road station, and was going to explain matters to them; but he was pushed down the steps.

In reply to the CHAIRMAN, witness stated that there was not an enormous crowd at the railway station—only the ordinary stokers; but as the policemen and the men marched along, of course the crowd grew. He was allowed to go into the railway station, but not on the side where the men were. There was no possibility of the men getting away, if they had not wished to enter the works, because the police were so close on either side that a man could not get out of the ranks if he chose.

In answer to Mr. LIVESEY, witness admitted one man who asked to leave the ranks might have done so. He believed that, if the men had been informed of the principal facts of the case, they would not have come to London. He objected to their receiving police protection, unless they were molested. He acknowledged that, if they had not received that protection at the towns and villages whence they came, as well as at this end, they would not have come. There was nothing to show that the men would have been molested, for the strikers were all perfectly sober. There was not a drunken man among them on the morning of the strike; and he believed that the new men could have been got in peaceably. He considered that to dismiss a man merely because he belonged to a trade organization was to intimidate him. They did not object to employers dismissing men for reasonable causes; but the excuse was made that a man was inefficient, when this was not the reason at all—the real one being that he had made himself obnoxious merely by belonging to a Union. He failed to see why a Magistrate could not, according to the evidence, decide as to whether or not a man had been dismissed properly. He objected to men contracting themselves out of the Employers' Liability Act. In some industries, men were absolutely compelled to contract themselves out of the Act; and he thought they did not get any corresponding advantage.

In answer to Mr. BOLTON, witness said he considered that the present law would be sufficient, if applied equally to employers and employed, to prevent intimidation on the part of the former. If employers of labour were at liberty to say they would employ whom they pleased, workmen had the same right to say they would work with whom they chose. The intimidation to which he referred was specially directed against delegates and collecting stewards. He did not object to masters insuring themselves against liability. He did not care, so long as the men or their families received compensation.

Mr. LIVESEY read to the witness an advertisement which he stated was put in all the country papers, to the effect that the stokers employed at the South Metropolitan Gas Company's works had given notice to leave their employment because a share in the profits had been offered; and having refused this offer, the stokers wished the Company to remove men who had accepted it. The advertisement also intimated that the Company had made arrangements to lodge and feed any new men on the premises, should it be necessary; and that the police authorities would give them the needful protection.

Witness remarked that this was the inducement to the men to come—the food, the tobacco, the beer, and the police protection. The Union also issued bills; but their agents were molested when they went to get among the men in the country. Besides, they had not the same funds that the Company had.

Mr. *A. Linton*, a member of the Union, was then called; and in answer to the Chairman, stated that he was in the service of the Commercial Gas Company. The eight-hour system came into operation there about the end of July, 1889. The men were receiving the same wages for the eight-hours' work as they had been paid for the twelve; and in some cases an increase. The men were doing more in the eight hours than they formerly did in the twelve. They were stoking fewer retorts, but putting in more coal. They did 216 scoops a day; whereas under the twelve-hour system they did 202. The work was more severe during the eight hours than it was when they worked twelve; still they liked the new system the best, as it gave time for recreation. The effect of the diminished hours had been shown in the financial results of the Friendly Societies. There had been less illness, and consequently fewer claims on the funds. The men were much more sober; and their wives, families, and homes had benefited. In case of disputes, he thought that the trade officials should not wholly and solely settle matters. The men who composed the Boards of Arbitration should be drawn from the ranks of the workers. He complained of the insanitary condition of many gas-works; and said he considered baths and wash-houses should be adopted.

This Section of the Commission then adjourned till the 31st inst.

The Birmingham Corporation Water Bill.—The Select Committee of the House of Commons on the Birmingham Water Bill, the report of whose proceedings is continued in another part of the JOURNAL, have adjusted clauses providing that the Corporation shall grant leases of 999 years to the owners, and 21 years to the tenants, of property in the watershed; making such conditions as may be necessary to secure the purity of the water.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Monday, May 16.

(*Lord* BALFOUR OF BURLEIGH, *Chairman*; *Sir* G. B. BRUCE, *Sir* A. GEIKIE, F.R.S., *Professor* DEWAR, F.R.S., *Mr.* G. H. HILL, M.Inst.C.E., *Mr.* J. MANSERGH, M.Inst.C.E., *and Dr.* W. OGLE, *Commissioners*.)

To-day the Royal Commission on the Metropolitan Water Supply held its first public sitting at Trafalgar Buildings, Charing Cross, and commenced taking evidence. The first witnesses called were representatives of the New River Company.

Mr. *J. Searle*, examined by the CHAIRMAN, said he had been Clerk of the New River Company for twelve years. From time to time Acts of Parliament had been obtained by the Company regulating their supply and charges. With regard to the increase of houses in their district from 1851 to 1891, the total was 66,568 for the 40 years. There were no facts to show that the increase had been anything but gradual. Within the last two years, however, there had been a little falling off. The district was now to a great extent built over; and what building there now was occurred mostly in Hornsey and to the north. Turning to the statement made out by the Company, it showed that the average daily supply in 1891 was 32,028,000 gallons. Of this quantity 22,500,000 gallons was derived from the Lea; and the remaining 10,500,000 gallons from the Chadwell springs and wells. For the last 40 years, the average number of new supplies had been 1664; and from that the probable average for the next 40 years could be calculated. An average taken in this way would not be fallacious, because the average increase in the population had a certain ratio to the total amount of water supplied. It would give a fairer idea of the ratio of increase over a long period rather than to take a limited number of years.

The CHAIRMAN: That would give a total demand at the end of the period in question of 70,500,000 gallons. Would the population increase at the same ratio?

Witness: Of course, it is impossible for us to say that the increase will go on at the same rate for the next 40 years; but even if it did (and that would be an outside number), there would be proper means of supply. The average daily consumption of water in 1872 was 24,440,000 gallons; and in 1891, it was 33,000,000 gallons.

If you apply that ratio to the present consumption of 33,000,000 gallons, would it not be fairer to say that in 20 years the increase would be 44,000,000 gallons, applying the same ratio of increase as you have to the 22,000,000 gallons?—No, I do not think that would be the fair answer. There was no reason to suppose that the growth would be so fast as that. We have taken 28·49 gallons per head of the population, on the basis of the figures, as the rate of future consumption. We have a constant supply; but it might be in some cases reduced.

Has not the tendency been to increase the supply per head of the population as there is a growing desire for comfort and even luxury in the use of water?—There has been that tendency; and we have felt the effect of it in having more water-closets and baths in recent years.

What is the most unfavourable state of circumstances in which your Company can be placed, extremely dry weather or long-continued frost?—One is about equal to the other. Both are very bad, either great heat and drought or long and severe frost.

What is the largest number of gallons you have supplied in a single day?—42,000,000. That was in January, 1891, for a single day.

By Dr. OGLE: The 1664 new supplies referring to houses are taken from the Registrar-General's returns. We should regard each separate tenement as a house. Flats let out separately we should treat as separate houses or tenements. That was what was done with the modern blocks of dwellings; consequently the number of new supplies estimated by the Company would not be the same as the number of houses found in the census report. The legal powers with regard to the supply of water from the New River are contained in Acts of Parliament passed in the year 1855 and subsequently.

Mr. *Joseph Francis*, the Engineer of the Company, examined by the CHAIRMAN, said he had had the management of the wells of the Company for 20 years, and had superintended the construction of the new wells. The printed statement which the Company had sent in gave their available present supply in detail. The supply was 31,000,000 gallons, of which 22,500,000 gallons were from the Lea; the remainder being from the Chadwell springs and wells.

The CHAIRMAN: Can you separate the 10,500,000 gallons, and tell us how much comes from wells and how much from springs?

Witness: During last year we took a daily average of nearly 2,000,000 gallons from the Chadwell springs; the difference, 8,500,000 gallons, was from wells. This quantity includes the entire spring supply.

On what basis is that calculation made?—The 34,000,000 gallons is arrived at by taking what each of the wells can do, and has done for a period of weeks together pumping day and night—taking each well separately, then adding them together, and finding the total of what they can all do. The 34,000,000 gallons was not the maximum quantity that could be taken from the wells; but it was the fair average of what could be obtained for a number of weeks together. We have never taken from each of them a certain quantity which added together made up that figure.

Witness then gave the depths of the various wells and springs from which supplies were obtained by the Company; adding that the policy of the Company had been to use the Lea water, and then bring in the supplies from the wells and springs above. All the wells had been constantly used except that at Cheshunt, with which very little had been done. From Broadmead, they could obtain 1,500,000 gallons by pumping continuously during the 24 hours. This had been done for several weeks together at all times of the year; but principally in the summer or autumn. The quantities were respectively: From Broadmead, 1,500,000 gallons; Amwell End, 1,500,000; Amwell Hill, 3,250,000; Hoddesden, 2,160,000; Broxbourne, 4,500,000; Turnford, 3,750,000; Cheshunt, 750,000; Hoe Lane, 3,350,000; Highfield, 3,000,000; Campsbourne, 3,350,000; and from the remaining well, nearly 500,000 gallons.

Have you ever taken those quantities of water simultaneously from those wells?—No we have never needed it. The figures by no means represented what could be got out of the well by working the engines a little faster. They were all worked at a very safe speed; and that was what was actually obtained.

Do you find that pumping from any one of the wells affects the levels in any of the others?—Only in special cases, and to a very limited extent. With regard to Turnford and Cheshunt Wells—one old and the other new—there was a very decided connection between them; and that was why only 750,000 gallons had been put down for Cheshunt. They were a mile distant from each other; but still there was some connection. Amwell Hill and Amwell Marsh Wells also affected each other. The quantities given above refer to when they were both at work in each case.

For how long can you say those quantities had been taken from the wells?—For weeks together.

Have you ever conducted any experiments to see whether the pumping of water at one point affects the supply at another?—Yes. I have carefully observed the level of the water as it stands in the other wells; and the result has been that they are not affected except in the cases I have mentioned.

Are you aware that complaints have been made to the north of your district, that the effect of your pumping operations has caused depletion of wells of the Cheshunt Board?—I do not think there is any ground for such a complaint. All wells or springs in the neighbourhood which come within the cone of depression caused by pumping are, of course, affected. Those who happen to be in the vicinity must be influenced. In that way the notion has arisen that the Company are affecting the wells generally; but there is no ground for it.

The Cheshunt Local Board have made a statement (it certainly affects the East London Company as much as yours, but I think it right to put it to you), that, having wells within their district, they considered it advisable to be as far as possible removed from the pumping operations of the two Companies. During the last five years, the East London Company have sunk a well at Waltham Abbey close to the Lea; and the result has been to drain two of their artesian wells, and also the artesian well of the Waltham Gas Company. These wells were driven 150 feet into the chalk; and the water does not now rise within 50 feet of the surface.—The level of the water in our wells has not sunk 50 feet, or anything like it; and not long ago the Cheshunt Local Board's Surveyor stated to his Board that the standing water-level in his new well was entirely unaffected by any pumping which the Companies carried on.

They state that the water in the river has been reduced, and that the volume of the natural springs has been diminished. Have you had any complaints of that sort made to you?—Only as to the level being affected in the springs in the immediate neighbourhood of our wells, and within a short distance of our shaft.

Have any of the local authorities in Hertfordshire made complaints of that kind to your Company?—There have been complaints of that sort. Enfield is within the district; but it is supplied by its own Local Board. They have a well for supplying the Great Eastern Railway works, which are entirely to the east of Enfield Town.

They say: "The Board is advised by their Surveyor, that the lowering of the water in the chalk is due to the sinking of wells by the East London and New River Water Companies."—We have only one well at Enfield (at Hoe Lane).

Do you say that, in spite of the pumping which you have carried on, you have never noticed the level of the water in the chalk sinking?—From Turnford northward there has been no lowering of the water-level whatever for the last 15 to 20 years that I have known it.

Sir G. BRUCE: Do we understand you to say there has been a considerable falling in the water-level for London?

Witness: Under London there has been a considerable falling; and that extends north up to Enfield.

Can you tell us to what extent that has been the case?—Under London the falling has been nearly 18 inches in a year; that is, the standing water-level.

Did you check that by your own wells?—Yes. We have wells at Hampstead which we are not using, and where we have the opportunity of measuring the level of the water. The flow of water in the upper valley of the Lea no doubt arose from the increased drainage that went on. The consequence was that the water flowing along the upper part was drawn into the springs. That accounted for the rivers and streams rising lower down now than formerly, because the water was so rapidly drawn off that the upper ground did not get so well saturated.

Mr. HILL: Could the proportion you have given from the wells be relied upon if they were pumping continuously?

Witness: Yes, because I have taken each well with its neighbour on each separate working; and the wells in most cases are not affected by the working of the wells on the other side, except in one or two cases. I have taken what we can get when the neighbouring wells are at work.

Supposing that, with this large amount of pumping, the cone of depression in regard to each well was altered, would it not cause a general depression?—I do not think so; simply a local depression. The harder we pump, of course, the more we lower the water; but in each case it means simply from a little lower level.

That would be the effect of the water in the chalk. In what way would that affect the surface?—I do not think it would affect the surface at all, except within the cone of depression. Of course, it does affect that area.

Is not there great danger then of pollutions from the surface finding their way down to the wells?—In all cases the surface is covered with clay soil and sand; and everything that comes on the surface is thoroughly well filtered before it can get downwards.

Does that apply to the water in the chalk?—You do not find the chalk on the surface. There is always clay or gravel. Inasmuch as the water lying in the chalk is always considerably under the ground, I do not see, even if we did do what you suggest, that it would possibly have the effect of drawing down pollution. The water does not stand on the surface; it is always some feet below.

To what extent do you lower the water in any of these wells by pumping? Supposing you ceased pumping for a week, would it rise?—Yes, in some cases 60 or 70 feet.

Supposing other parties within the watershed were to go on pumping (such as the East London Company and the owners of private wells), you do not think it would have an effect, if you were all pumping from the same underground reservoir?—I do not think that any wells which the East London Company could put in their district would affect the yield of ours at all.

I suppose there is a limit to the quantity of water that goes into the chalk?—Yes, there is a limit; but taking into account the percolation that may be anticipated, and the large area available, there is enough for all.

I do not see how you can rely upon that, when you do not know what the effect of these large pumping operations may be?—We find that what we pump has practically no effect upon the surface level; and therefore it is evident a much larger quantity can be pumped without doing any appreciable harm. From calculations we have made as to what the supply in the chalk is, we feel there is no fear of doing any harm to the water-level in the chalk. The water we pump is on its way to the south-east of London; it does not go into the River Lea at all. If not taken by us, I think it would find its way into the Thames at Woolwich. It would not affect the water in the rivers or streams within the Lea district. There is nothing from which the River Lea water can be polluted. The river is carefully patrolled at night, on Sundays, and at other times; and it is most carefully guarded from pollution of any sort.

Sir A. GEIKIE: You admit the lowering of the water-level under London. To what do you attribute that?

Witness: To the increased pumping that has taken place from under London itself; and to the difficulty which the water has in getting down there. The channels in the chalk which communicate between the upper part of the valley and the basin under London are restricted, I imagine. It cannot get down rapidly enough to those points. There is a relation between the rainfall and the level, which after wet seasons is somewhat higher, and after dry seasons somewhat lower. But it does not flow immediately; and it is difficult to trace the connection except in that general way.

Now, from your statement, it appears that the whole discharge from the Lea has been only from 61,000,000 to 63,000,000 gallons; and that at the present time the water taken amounts to more than 70,000,000 gallons odd—that is to say, the water drawn by the various Companies from the river. Therefore the quantity drawn from the Lea is sometimes greater than the amount it discharges. What I want to know is, what you propose to do when the water discharged by the Lea falls to 61,000,000 gallons, as stated in your table?—Of course, the difference would be made up by pumping from wells, if there were at any time a short quantity in the Lea. But it cannot be correct that 70,000,000 gallons are taken out.

Yes, 70,000,000 gallons; these figures are taken from the Local Government Board reports. Does that include water drawn from the wells?—That is water taken only from the Lea.

What is the condition of the Lea generally?—There is always plenty of water in it. I do not think it is the case, as stated in one report, that the Lea is sometimes reduced to the condition of a stagnant pool. There is plenty of circulation in the water; and there would be no difficulty if it were not for the necessity of flooding—if it were kept free from sewage matters, which always require an enormous quantity of water for flooding purposes.

The CHAIRMAN: Is it not the fact that your Company do practically take all the water out of the Lea?

Witness: We provide for the navigation. That is always provided for.

What is the population in the valley of the Lea above your intake?—We have not got the last census returns; but for 1881 it was 111,000. Among that number, there are several towns of above 10,000.

What is the population the drainage of which goes more or less into the valley of the Lea above your intake? I want to know how much of that is rural, and how much is collected into urban districts?—I only have it down to Field's Weir (referring to map).

No; that will not do. I want it above your intake. Perhaps you will supply us with that?—Certainly. Luton is on the intake, 10 miles above. Their sewage is very carefully kept away from the river, and is dealt with on a sewage-farm some distance away. The character of the country above the intake is quite agricultural; and there is a good deal of arable land there. There is no greater difficulty in obtaining a supply of pure water from the Lea than at any former time; and, in fact, we are not only able to keep up to our previous standard, but are constantly improving it. Analyses are made from time to time of the quality of the raw material—that is the water taken at the intake.

Can you say whether the water where you begin to deal with it is better or worse than it was ten years ago?—From observation, I should say it is decidedly better. The Lea Conservancy take great pains to prevent anything like pollution. Their officers stop anything going into the stream which should not pass into it. Great improvements have been made.

Can you mention any place where the system has within recent years been changed?—There is the case of Luton. Ten years ago that was not so well arranged as it is now, and that was due in some measure to the efforts of the Lea Conservancy. It would be possible to store the surface water which now goes down the Lea in the winter months. Though that matter had been considered by the Directors of the Company, no scheme has been put forward; but it is known what quantity of water can be stored. There would be an average of 10,000,000 gallons a day throughout the year.

On what basis is that arrived at?—We take the winter months, and after allowing for what is wanted for the navigation and for the daily use of the two Companies, and dividing the surplus up, it gives that amount for each. I do not see any reason why 365 times 10,000,000 gallons should not be stored in the year.

But that would only be the rate for the winter months?—There are 40,000,000 gallons going down during those six months.

If you are going to store a supply for the summer months out of the surface water, your daily storeage capacity must not be calculated upon 10,000,000 gallons, but on 20,000,000 gallons for six months to be kept over the other months. Have you ever made that proposal to the Directors?—No; we find the sinking of wells a far more easy way of doing it.

At the end of April, for instance, you would have a large quantity in your storeage reservoir?—Yes; 3,650,000,000 gallons.

Have you sites where you could store that quantity of water?—Yes; north of Walthamstow there are sites where reservoirs might be constructed.

Have you ever thought of what the cost of making such reservoirs would be?—I suppose it would cost at least £300,000 or £400,000 to make them. That is, of course, a very rough figure.

What would the people lower down the stream say to having a head of water of that kind above them?—There would be no great danger. I do not think it would be reasonable to make the reservoirs of any great depth. There would be no danger of any great head of water; the ground does not suit itself to that.

Sir A. GEIKIE: Could you find any other sites?

Witness: I think that at Sewardstone sites might also be found for reservoirs.

That would necessitate large puddling?—The London clay does not extend up there, so that it would be more expensive to make them.

Your Company have seriously considered the possibility of having to make these reservoirs?—Yes; it has been very carefully considered.

Professor DEWAR: Have you any evidence as to the effect of your pumping? Can you give any definite average area that is affected by it?

Witness: No; I do not think so. You must take each case by itself.

You cannot say, even where the wells are most congregated together, that the surface of the streams is most affected.—No; we cannot reach any definite cone or inclination.

I understood you to say that the wells were affected to the extent of some 60 or 70 feet on the stoppage of pumping for a week?—No; the answer I meant to make was that, when we pumped down to a depth of 60 or 70 feet, the water rose.

Then you must have the same equivalent cone; but you say you cannot give any estimate as affecting the surface?—No; the population seems to be very slowly increasing over this area. Taking the whole area the increase has been by no means rapid; and their demands have been more than met.

With regard to the character of the flood water in the Lea, it has been fully substantiated that it is exceedingly bad, has it not?—No, I do not think so. The worst time of the flood is just at the commencement; and then we take means to shut it off—taking in as little as possible of it. But as soon as the first flush of the flood water is over, the water is not bad. There is a good deal of sand and clay in it; but there is no pollution—all the pollution has been cleared off.

You do not agree with the statement that the extent of the pollution is equal to that of the Thames at the main drainage outfall at Crossness?—The floodwater at our intake is never even anything approaching bad. It has neither smell nor any of the characteristics of sewage; though it is black from sand and soil. There is no necessity whatever for the filtration of the spring water; and the quality of our water stands among the highest in the list usually given, both with regard to organic impurity and the amount of oxidizable organic matter.

That is among river-derived waters?—Yes.

Mr. *Ernest Collins*, M.Inst.C.E., examined by the CHAIRMAN, said he was employed by the New River Company, in charge of their distributing works, and was responsible for the tables given in the Company's printed statement referring to his employment at the works. In 1872, the yearly average quantity of water per head per day supplied for all purposes (trade and domestic) was 27·10 gallons; in 1881, it was 28·77 gallons; and in 1891, it was 28·49 gallons. In 1872 they had no part of their district under constant supply. In 1881, they had 17,557 houses under constant supply; and in 1891 that had risen to 68,000, out of a total number of 154,568 houses. To put it shortly, the consumption per head per day increased between 1872 and 1881 to the extent of 1·67 gallons; but in the next ten years, it decreased to 0·28 gallon. Between 1871 and 1881, the parish of Shoreditch was the first district which was put under constant supply; and that accounted for the increase of consumption between 1871 and 1881. It was only caused by the bad state of the fittings in the district, and the inability of the Company to get the consumers to put them in order. Subsequently the Company made efforts to suppress the waste; and by this means reduced the consumption very considerably. In fact, they brought it back almost to its previous state. The Company had devoted some time and attention to this suppression of waste, and had 38 inspectors constantly employed in visiting houses for the purpose of checking it. They visited houses during the daytime; and where they found defects, they served notice on the occupiers. But they had great difficulty in getting the repairs carried out.

The CHAIRMAN: Have you any means of testing your mains, to show the extent of flow at night?

Witness: Yes, we can trace wherever there is a flow at night by meters; and when we detect that, we visit the district in the daytime.

Do you think 28 gallons per head per day is a safe quantity to calculate as the amount that will be required in the future?—I think it ought to be taken as the maximum, as far as the New River Company are concerned, for all purposes, trade and domestic.

Is your district one in which there are good sanitary appliances, water-closets, and so on?—Yes; and they are increasing very much. Formerly there was only hand-flushing in houses. But now every house of above £20 a year has its water-closets; and houses of £25 have two water-closets and a fixed bath.

Has that consumption reached its maximum, do you think, or will it go on still more?—With the means we have of checking waste, we can maintain our supply at a fair rate of consumption. You cannot compare London with any other town; the conditions are so different. We have here more baths and water-closets.

By Sir J. B. BRUCE: The Company give a large supply for manufacturing purposes, and have all the termini of the great railway companies on the north of the Thames within their district. About 25 per cent. of their supply goes in this way.

By Mr. HILL: There is a tendency to an increased supply; but it is not necessary to look forward to a much larger consumption than

28½ gallons, because there is great waste going on in the district which can be prevented.

By Dr. OGLE: For domestic purposes 75 per cent. is used.

By the CHAIRMAN: It is the fact that a migration of population is going on from London to the more suburban districts, but not that the further out they go, the fewer persons there are per house. In some parts decidedly the population per house is falling in number; but the day and night populations must be distinguished.

The CHAIRMAN: Taking the census or sleeping population, would not the average per head per house over the whole of your district be lower now than formerly?

Witness: No; I do not think it would.

When you say "a supply," does that mean a house?—It does in some cases. In other cases, it may mean a group of houses. In laying on a block of modern dwellings, we have taken each tenement as a supply.

And if you calculate the same per head as you did 20 years ago, where there was only one kind of supply, is not there room for fallacy?—No; I do not think so.

If I am right in supposing that the number of people per head per house is smaller than it was 20 years ago, it would mean that they were using more water per head, because the average of supply is the same. Inasmuch as the quantity consumed per supply remains pretty much the same, and each person is consuming more, there might be room for fallacy in the calculation?—It might be so.

Mr. *Edmund L. Morris*, M.Inst.M.E., C.E., examined by the CHAIRMAN, said he had been connected with the designing, manufacture, and working of various kinds of machinery (chiefly engines) for 30 years, and had been Engine Superintendent to the New River Company for 12 years. He had also had charge of the filtering operations. Witness stated what quantities the engines at the wells were capable of raising when working up to their full power. The filtering-beds were, he explained, roughly speaking, large basins constructed of brick, and were in extent from half to one acre. At the centre there was a depression from which the filtered water passed. Along the bottom were laid drain-pipes; over them was laid shingle; and above that 2 feet of sand. Only the upper portion above the sand was in connection with the water from the river; the culverts below running to the suction wells, from which the water was drawn. There were no possible means of communication between the filtered and unfiltered water. All the water had to go through the filtering-beds. After a bed had been at work for a certain period (depending on the clearness and purity of the water), it was cleaned. The water passing from the beds was under systematic daily examination at each station. Every care was taken that the water should be properly filtered.

This concluded the evidence on behalf of the New River Company. On the following day, witnesses for the East London Company were examined; and the Commission adjourned till the 30th inst. The report of the second day's proceedings will appear next week.

BIRMINGHAM CORPORATION GAS DEPARTMENT.

Annual Report.

The report of the Gas Committee of the Birmingham City Council or the year ended March 31 last, has been issued; and from it we earn that the Committee have sanctioned an expenditure of £2300 in the purchase, from West's Gas Improvement Company, of four additional charging-machines for use at the Saltley works. This will complete the equipment of No. 3 retort-house with charging and drawing machinery. An expenditure of £595 has been authorized in the provision of additional railway siding accommodation at the same works. A portion of the retorts in No. 4 retort-house at Swan Village having to be reset this year, the Committee have given authority for the expenditure on capital account of £412 in the reconstruction of their retorts in beds of sevens, instead of fives as at present. The retorts which have been previously reset in this house have been altered in this way, whereby, it is said, an increased production and a more economical working have been secured. It will shortly be necessary to reset some of the retorts in the adjoining retort-house, when it is proposed to take the opportunity of effecting a similar improvement in that house. In order to meet the requirements of the increased manufacture at the Windsor Street works, an expenditure of £1900 has been authorized in the purchase of two larger locomotive engines than those hitherto employed, and in strengthening the railway viaduct. The smaller engines formerly used have been sold for the sum of £600. Proceeding, the Committee remarked that, on receipt of a notice from the colliery-owners supplying gas coal under the current year's contracts that they would be unable to continue deliveries during the recent stoppage of the miners, it became necessary to purchase additional coal in anticipation of the cessation of supplies. About 12,000 tons of coal were bought for delivery during the fortnight preceding the stoppage, of which 9000 tons were forwarded within the time stipulated. For these extra supplies, prices in advance of those given under contract were paid. On the resumption of work by the miners, the Committee informed their contractors that, having made these additional purchases, they were not in a position to receive, as arrears on the contracts, the coal which should have been delivered during the cessation of work. Having regard to the yearly increasing difficulty of obtaining the supply of cannel coal required for the purpose of maintaining the illuminating power of gas to the standard, the Committee report that they have made inquiries as to the processes now in operation in other large gas-works in the country for the purpose of carburetting gas with oil. They have also made inquiries as to other processes now coming into use for the employment of oil in the process of gas-making; and they have entered into an arrangement with the Gas-Oil Syndicate for carrying out an experiment at Windsor Street, at the cost of the Syndicate, of a new carburetted water-gas plant for which they hold the patents. The rearrangement and enlargement of trunk mains which has been in progress during the past two years will be completed in the current year. In carrying out these alterations, it has been found possible to make a saving on the original estimate of £22,580; and the Committee have authorized an expenditure of £6100 on the work now required—making the total cost of the work £20,630. The contract with Messrs. John Aird and Sons for main-laying and service work having terminated on March 31 last, the Committee, having regard to the necessity of the careful performance of the work for the safety of the public, and to the satisfactory way in which it has hitherto been done by Messrs. Aird, have renewed the contract with them for a further period of five years from that date. Referring to the Bill promoted by the Corporation of Sutton Coldfield for the purchase of the Sutton Coldfield gas undertaking, the Committee state that it has been withdrawn, not having received the sanction of the ratepayers. The Directors of the Gas Company have now renewed their offer to the Committee of their mains and distributing plant within the parish of Sutton; and this offer is under consideration. Messrs. P. Spence and Sons have informed the Committee that it would be a convenience to them to know what arrangements the Corporation propose to make for the disposal of the ammoniacal liquor produced at the gas-works after the expiration of the contract with them on June 30 next year. In connection with this subject, the Committee have carefully considered whether they should themselves undertake the manufacture of sulphate of ammonia. They are of opinion that, if they can obtain satisfactory tenders for the purchase of the ammoniacal liquor, they should not extend their operations in this way; and they are now inviting tenders for the purchase of the liquor for a period of ten years from June 30, 1893.

The Committee submit the balance-sheet and statement of accounts for the year ended March 31, 1892, showing a net profit amounting to £22,144. No appropriation has been made from the profits of the year to the sinking fund for the redemption of loans and annuities, having regard to the large sum which was appropriated to this fund from the profits of the previous year. The Committee recommend that the balance of net profit shall be appropriated to the improvement rate of 1891; they have informed the Finance Committee that they hope to be able to pay to the improvement rate the sum of £25,000 out of the profits for the year ended March 31, 1893.

The following are the principal items (shillings and pence omitted) of the revenue account, preceded by those of the previous year:—

Expenditure.

1890-91.		1891-92.	
£250,594	Coals	£271,044	
3,582	Purifying materials and wages	6,442	
4,790	Salaries at works	4,726	
52,725	Wages at works	56,916	
75,092	Repairs and maintenance	76,471	
			£415,601
	Distribution of gas—		
12,238	Salaries in light office	£12,137	
16,353	Repairs, maintenance, and renewal of mains and service-pipes	16,693	
6,196	Repairing, renewing, and refixing meters	6,366	
			£35,197
2,561	Lighting and repairing public lamps		2,757
17,952	Rent, rates, and taxes		15,129
8,188	Management		8,675
1,509	Law charges, bad debts, expenses on loans and annuities, &c.		2,507
£451,786	Total expenditure		£479,870
131,246	Balance carried to profit and loss account		114,170
£583,032			£594,041

Receipts.

£423,058	Sale of gas	£453,086
154,913	Residual products	135,496
1,953	Rents	1,928
2,180	Fittings	2,370
925	Discounts and transfer fees	1,159
£583,032		£594,041

Included in the total receipts from the sale of gas are the following items: Common gas, 1,282,370,500 cubic feet, at 2s. 7d. per 1000 cubic feet, £165,639; ditto, 555,318,500 feet, at 2s. 5d., £67,100; ditto, 1,997,238,800 feet, at 2s. 3d., £224,689; and public lighting and under contracts, £11,614.

STAFFORD CORPORATION GAS SUPPLY.

Annual Report.

In the last issue of the JOURNAL, a brief notice appeared of the annual report and accounts of the Stafford Corporation Gas Committee, which were presented at the quarterly meeting of the Town Council in the previous week. A copy of the report has since come to hand; and we are therefore now able to give some further particulars concerning the operations of the department during the year ending March 25 last.

The report states that the quantity of gas sold and the profits made during the year were greater than in any previous year since the Corporation acquired the undertaking. The large increase in the sale of gas referred to in the previous report has been more than maintained, as was anticipated; the quantity made this year being 112,123,000 cubic feet—an increase of 9,294,000 feet, or 9·04 per cent.; thus evidencing increasing prosperity in the borough. Although coal has been somewhat easier in price, the market for residual products has suffered from severe depression; so that the prices realized from this source have been much less per ton than in the preceding year. The coal carbonized amounted to 12,595 tons, being an increase of 1311½ tons. The sum received from the sale of gas was £14,449—being an increase of £1103; and it was paid as follows: £12,413 from quarterly consumers, £812 from fortnightly consumers, and £1223 for public lighting. The residual products realized £4143; being £2345 for coke, £1062 for tar, and £736 for sulphate of ammonia. The total receipts for the year amount to £19,121; and the expenses to £11,939—the gross profit being £7182, out of which there has been paid £2936 for interest on loans, £1579 for repayment of loan, and £172 for income-tax; leaving a net profit of £2495, which added to £20 brought forward, makes the sum of £2516 to be dealt with. The Committee recommend that £500 be added to the reserve fund, that £1500 be paid to the district fund in aid of the district rate, and £500 to the borough fund for the account of the Bath Committee

to completely equip the baths without further charge upon the rates), and that £16 be carried forward. This will make the reserve fund £1636, loans repaid £16,606, and a total sum of £21,600 paid in relief of the rates. Referring to the extensions and improvements at the works, the Committee remark that these have been vigorously prosecuted during the year. The large gasholder has been telescoped; so that its capacity is now doubled; a new retort-house has been erected, and will be ready for work next winter; new coal-stores have been built alongside the retort-houses; and an improved washer-scrubber has been erected. A bridge has been built over the river; and the railway siding has been completed, and, now that it is in full working order, will effect a very considerable saving in future operations. Other extensions and improvements are in progress, and will be finished during the current year. The works will then be as complete as modern engineering science can make them. For these results the Committee will be mainly indebted to their excellent Engineer (Mr. J. F. Bell), whose special services, they say, deserve recognition at the hands of the Council—the continued and increasing success of the gas undertaking being so largely the result of his labour and ability. With respect to the future, the Committee recommend that no charge shall be made for meter-rents; and, in order that the relief so given may be equitably apportioned between large and small consumers, that the sliding scale of discounts be extended as follows: To consumers whose consumption is under 10,000 feet per quarter, 2½ per cent., as at present; over 10,000 feet, 5 per cent.; over 50,000 feet, 7½ per cent.; and over 100,000 feet, 10 per cent. This will cost the department about £700 per annum, and will be equivalent to a reduction of nearly 2d. per 1000 cubic feet on present prices. The Committee feel they are quite justified in making these recommendations, and that the result will be a substantial increase in the consumption of gas, as heretofore, owing to the reduced price, which will now bear favourable comparison with most towns in the kingdom.

In moving the adoption of the report at the meeting above referred to, Alderman W. H. Peach said he had never submitted a report with greater pleasure since he had been Chairman of the Committee. He alluded at length to some of the details in the report, and remarked, with respect to the proposal as to the baths, that he believed it would generally commend itself to the ratepayers. After consideration as to the meter-rents, they had decided to recommend a sliding scale in the way of discount, as set forth in the report; and they had done all they could to encourage the use of gas instead of steam power for engines.

The report was adopted.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Tuesday, at the London Offices, 30, Gracechurch Street, E.C.—Mr. ALFRED WILLIAMS in the chair.

The SECRETARY (Mr. S. Wood, A.C.A.) read the notice convening the meeting; and the Directors' report and the statement of accounts (of which a summary appeared in the JOURNAL for the 10th inst.) were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said the shareholders would have observed that the Directors on this occasion recommended a little less dividend than usual. This arose partly from the loss of a portion of the public lighting, which had been given over to the Electric Lighting Company. Although the Directors might, out of the accumulated funds, have paid the ordinary dividend, they thought it wise policy not to do so; but to wait and see what the effect of the loss of a part of the public lighting would have upon the revenue. He hoped they would soon return to the usual payment.

Mr. C. GANDON seconded the motion.

The CHAIRMAN, in reply to Mr. Hartley, said that 315 of the public lamps had been taken from the Company as from Jan. 1, 1892; and they had 194 left. The electric light was now in operation. Regarding the private consumption of gas, their last return was very nearly what it was for the corresponding period of 1891—in fact, the difference was scarcely worth notice. As to the cost of the electric light, in comparison with gas, he could not at present commit himself to figures.

Mr. GANDON observed that the Electric Lighting Company had only been in full operation since the beginning of the year; and so it was impossible for anybody to say yet what the cost would be.

The motion was then carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. R. BERRIDGE, a dividend was declared on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital of 6 per cent., both less income-tax (excepting upon those dividends payable to the local shareholders).

The retiring Directors (Captain H. Thurburn and Mr. R. Berridge) were re-elected; and Mr. Manwaring was appointed Auditor in the place of Mr. Berridge, who resigned on his elevation to the Board.

The next business had reference to the appointment of Mr. Wood as Secretary, on the election of Mr. Alfred Lass as a Director. It appeared, from statements made by the Chairman and Mr. E. K. Blyth (the Solicitor), that, as the Company is constituted under the laws of British Guiana, the Board have the power to appoint a Secretary, but the shareholders should fix the salary and the terms upon which he is engaged.

Mr. MAGNUS OHREN moved a resolution to the effect that the arrangement made with Mr. Wood for carrying on the secretarial duties be upon the same terms as those on which the previous Secretary held the office—viz., £100 per annum salary, £100 for office and clerk, with the addition of £20 for every 1 per cent. paid on the ordinary share capital over 5 per cent.

Mr. BLYTH seconded the motion, which was agreed to.

A special resolution was then passed, expressing the shareholders' warm and cordial appreciation of the services rendered to the Company by Mr. Lass during the many years he held the office of Secretary.

The proceedings concluded with votes of thanks to the Chairman and Directors, and to the Secretary (Mr. Wood), the Local Secretary (Mr. F. A. Conyers), the Engineer and Manager (Mr. T. B. Younger), the Auditor (Mr. Magnus Ohren), and the Solicitor (Mr. Blyth).

MOSSLEY CORPORATION GAS SUPPLY.

A Loss on the Past Year's Working.

At the last Meeting of the Mossley Town Council, the report of the Auditor on the accounts of the Gas Department for the past financial year was submitted.

It stated that, after charging the profit and loss account with the ordinary provisions in respect of the sinking fund, and with the interest on loans, there was a loss for the year of £272. The price of gas had remained the same during the year; while the total rental showed an increase—the difference in the result arising mainly from (1) increased cost of repairs and maintenance of plant; (2) increased cost of the repairs of mains and services; (3) reduced amount received from coke. The total consumption had been 74,233,900 cubic feet, as compared with 72,786,000 feet; and the percentage of unaccounted-for gas had been 12·25, against 13·97, or a decrease of about 1¾ per cent., which might probably be still further improved as they began to receive the full benefit of the completion of the change in the mains and service-pipes. In moving the adoption of the report, Alderman Buckley called attention to the loss on the year's working. This, he said, had arisen from expenditure of an extraordinary character, which had been taken out of the revenue. The repairs had been heavier at the works, and the item for labour was greater than in the previous year; and, in addition, there had been a considerable outlay on mains and service-pipes. Next year their position would be more satisfactory, as the leakage had been considerably reduced. Then, the Committee had received £276 10s. less for coke; and there had been an increased charge in the establishment account of £89. The total of the items referred to amounted to £1507; but against this sum there was the increased price received for tar, &c. But for these items, the gas would have been produced for about 2s. 10d. per 1000 cubic feet, instead of a little more than 3s. 1d. He thought, if they could bring the establishment charges down to a decent figure, they would be able to make a fair profit next year; and he also believed that, as they had not now a large stock of coke on hand, they might raise the price, for there was no reason why they should charge 2d. per ton less than Ashton and Stalybridge. Mr. Marland seconded the motion. Mr. Sykes considered the Auditor's report a very unsatisfactory one; as it appeared that they were losing upon the small consumers at the rate of 1¾d. per 1000 cubic feet. A lengthy discussion ensued, in the course of which Mr. Mitchell charged another member of the Council (Mr. Jones) with having made some very insulting remarks regarding the Chairman of the Committee and the Gas Manager; and, in his reply, Alderman Buckley said the charge which had been made could be proved by reliable witnesses, and if the two gentlemen alluded to were advised by him, Mr. Jones would get into serious trouble. The report was adopted.

THE DISPUTE AT THE LONGWOOD GAS-WORKS.

Intimidating a Workman.

On two or three occasions recently, references have been made in these columns to a dispute between the Directors of the Longwood Gas Company and some of their old workmen, who were discharged on the 1st ult. on the grounds that they were incompetent, and not doing the right amount of work. Since then pickets have been stationed near the works; and it has been necessary, for the protection of the new hands, to have police officers on duty at the works night and day—indeed it is said that it has been unsafe for any of the men to leave the works without being accompanied by a constable. One of the new employees who seems to have particularly displeased the discharged men is Mr. J. J. Merrell, the son of Mr. R. Merrell, Manager of the Mossley Gas-Works; and a few days ago the ringleader of the pickets, a man named John Walker, had to appear at the Borough Police Court on the two charges of persistently following Mr. Merrell with a view to compel him to refrain from his work, and of using violence towards him, so as to intimidate and keep him from following his employment. The complainant was represented by Mr. Sykes, who stated that Mr. Merrell resided between Mossley and Greenfield. On the 30th ult., he left the gas-works accompanied by a constable, who went with him to the railway station. Arriving there, Mr. Merrell purchased a ticket; and Walker, in the presence of a man named Cane, also came on the platform and called Merrell a "blackleg," and used other not very complimentary terms towards him. Complainant entered a compartment and Walker entered the next one. When the train stopped at Golcar, defendant got out, and went to the door of the compartment in which Mr. Merrell was seated, and commenced using the most violent threats to him. He not only employed threats, but practically he attempted to use violence; for he tried to strike him through the carriage window. After the train started again, defendant hooted him. This was the intimidation of which he complained; and he expressed the hope that, if the Bench found the case proved against Walker, they would make an example of him. Mr. Merrell gave corroborative evidence; and then four or five police officials testified as to the condition of affairs at the works. On the whole, they considered the pickets had behaved very well. No witnesses were called on behalf of the defendant; but Mr. Wright, who appeared for him, contended that, when the case was stripped of all the outside elements, the evidence as to intimidation became very small, and that with regard to following was almost *nil*. The Bench, having considered the matter in private, inflicted a fine in the first case of £5 and £1 1s. 6d. expenses; and in the second case, one of £5 and 10s. costs. Mr. Sykes asked the Magistrates to fix default. The Magistrates' Clerk replied that this was a case for a distress warrant if the fines and costs were not paid; he asked Mr. Wright if he knew anything about payment. Mr. Wright (after consulting with Mr. Cockayne, the Local Secretary of the Gas Workers' Union) said he had no suggestion to make. The Magistrates' Clerk remarked that a distress warrant would be issued.

The Wenham Company, Limited, have been again entrusted with the gas lighting at the Royal Opera House, Covent Garden, for the season.

ELECTRIC LIGHTING FOR MANCHESTER.

Local Government Board Inquiry.

Last Tuesday, Mr. S. J. Smith, one of the Inspectors of the Local Government Board, held an inquiry at Manchester into an application by the Town Council to borrow £150,000 for purposes of electric lighting. Sir John Harwood was first called upon to give evidence. He said the Corporation had had the question of electric lighting under consideration for the last ten years at least; and in 1890 an Electric Lighting Order was obtained from the Board of Trade. In fixing upon the area of supply, the Gas Committee had been guided by their own knowledge of the requirements of the city; but they had also received suggestions from the citizens. Dr. John Hopkinson had been employed by the Corporation to carry out the work. He himself thought that the money now applied for was little enough, and that it would have been better to borrow £200,000. The site which had been secured for the generating station was regarded as very suitable. The contracts which had been already let and others which would be given out shortly amounted to £78,000. Inquiries for the light had been received from persons outside the compulsory area; and if the circumstances and the probable consumption made it appear desirable, the Corporation would extend the area, and give every facility they possibly could to induce people to use the light. Of course, they were not seeking to make a profit out of the scheme in any way; they were only wishful to develop the resources of the city. Mr. Brooks, the Chairman of the Gas Committee, confirmed the evidence of Sir J. Harwood. Dr. Hopkinson, who was next called, said the district to be lighted extended to something like a mile, and this necessitated the employment of reasonably high pressure. The best system for this was the five-wire one, which gave a high pressure, and at the same time enabled them to supply ordinary lamps, and to turn them out separately. There was sufficient room at the generating station for additional machinery as the demand increased. In reply to the Inspector, who inquired whether it was proposed to light the street lamps with electricity, Dr. Hopkinson said the lighting of the streets was not at present contemplated; but no doubt something would be done in that way. As Sir J. Harwood had stated, the contracts already and about to be let amounted to £78,715; and the cost of the site and such additional works as might be from time to time required was set down at £71,285—making a total of £150,000. This amount, he thought, would very soon be spent, and in all probability more would be needed in the future. The inquiry then closed.

EXHIBITIONS OF GAS APPLIANCES.

Last Tuesday, Mr. E. C. Milligan, the Chairman of the Buxton Local Board Gas Committee, opened an exhibition of gas appliances in the Town Hall. In the course of the address delivered by him on the occasion, he referred to the great progress that has been made of late years in the application of gas, especially for domestic and culinary purposes, and said that at the present price in the town (2s. 6d. per 1000 cubic feet net), its use was cheaper than coal. The exhibits were by Messrs. Richmond and Co., Limited, of London and Warrington; and Mrs. Golding, of London, gave practical lessons in cookery during the exhibition, which remained open till Friday. The arrangements were admirably carried out by Mr. G. Smedley, the Gas Engineer to the Local Board. Under the auspices of the Chelmsford Gaslight and Coke Company, an exhibition of gas appliances from the same firm was opened by the Mayor (Mr. John Taylor) in the Corn Exchange yesterday week. The proceedings commenced with a brief address by Alderman W. W. Duffield, the Chairman of the Company; and the Mayor having declared the exhibition open, Mr. E. W. T. Richmond discoursed upon "Gas as a Domestic Servant." The cookery demonstrations were given by Miss May Morrisson. A five days' exhibition of gas-stoves manufactured by Messrs. R. and A. Main, of London and Glasgow, was opened by Alderman T. T. Sedgwick in the Corn Exchange, Darlington, last Tuesday. Free lessons in cookery were given each day by Miss Burden. The same firm have been exhibiting at Middlesbrough and Newcastle-upon-Tyne, with Miss Burden's co-operation as demonstrator. The exhibitions were carried out by the firm's representative (Mr. J. A. M'Lay). At Gateshead, on Tuesday last, an exhibition of cooking and heating appliances, manufactured by Messrs. John Wright and Co., Limited, of London and Birmingham, was opened in the Town Hall in the presence of a large attendance of the general public. Owing to its success, it is to remain open until Thursday this week. Practical lectures on cooking by gas are being given every afternoon and evening by Miss Shaw, of the Nottingham School of Cookery. The same firm also held an exhibition at Middleton, commencing on Wednesday afternoon. At the opening proceedings, the Chairman of the Corporation Gas Committee (Mr. G. Booth) presided. In addition to the gas-stoves of various descriptions, which were ranged round the room, there was a good display of the Wenham Company's regenerative lamps. A course of lectures was delivered by Miss Haxsmith. During the past week, a successful exhibition of Messrs. Richmond and Co.'s "Model" ranges was held in the Public Hall, Rochdale. On Thursday evening, a lecture was delivered by Mr. E. W. T. Richmond on "Gas as Fuel." Lectures on cookery were given by Miss Owen and Miss Smedley. The Brentford Gas Company have authorized the firm to hold a series of exhibitions in their growing districts; and during last week another exhibition of the series was held at the Lyric Hall, Ealing, and was very successful. It will be continued this week. The Davis Gas-Stove Company, Limited, have been busy holding exhibitions lately. At the Albert Hall, Portsmouth, they displayed their well-known gas-stoves from the 10th to the 20th inst.; Miss Ellen Johnston delivering lectures on cookery twice daily. At Aberavon, where they had the co-operation of Miss M. A. Rotherham, they held an exhibition from the 10th to the 13th inst. In the Corn Exchange, Hereford, the firm opened an exhibition of their gas appliances last Thursday, and will continue it till to-day; Miss Ida Cameron giving demonstrations in cooking by gas twice daily.

THE STANDARD OIL TRUST OF AMERICA.

In view of the prominence given, at the recent meeting of the Incorporated Institution of Gas Engineers, to the subject of the use of oil for the production and enrichment of coal gas, the following article, contributed to the *Forum* by Mr. S. C. T. Dodd, Solicitor to the Standard Oil Trust of America, detailing some points in the history of the Trust, and of the petroleum trade generally, will doubtless prove interesting to our readers:—

The main purpose of this article is to show how one Trust decreased prices. The discovery of petroleum by boring through rock strata was made in 1859. As it was soon obtained in large quantities, the question arose of its utilization and of finding a market for its products. A number of manufactories were erected for refining the crude article; but for many years the product was poor and dangerous, and the enterprises were not financially successful. A few persons, who afterwards became well known in the trade as Standard Oil men, entered into partnership, and erected a refinery at Cleveland. It was not until January, 1870, that their business became sufficiently important to justify the formation of a corporation for the purpose of carrying it on. They then organized the Standard Oil Company, with a capital of $1,000,000. This Company continues to manufacture petroleum products at Cleveland; its capital now being $3,500,000. But the business in which these persons were interested could not be confined to the city of Cleveland. To hold and increase their trade, these men early saw that more than a local business must be done. The supply of petroleum came from Pennsylvania; and in that State it was essential that corporate agencies should be established. They allied themselves with other persons engaged there in the same industry, and either organized corporations or purchased the stocks of corporations already organized, in order to carry on business in that State through corporate agencies. A Standard Oil Company was founded in Pittsburgh for the same purposes as the one started in Cleveland; and the stocks of these two Companies were eventually owned by the same persons. These individuals thereafter continued actively, individually as well as through the agency of several corporations, to extend and increase their petroleum business. They established agencies in different States for the sale of their products; and when the business of such agencies became of sufficient importance to warrant it, they organized corporations according to the laws of the proper States, in order that the industry might be carried on under corporate agencies. They located manufactories at the sea-board for the export trade, which rapidly became enormous. They began the manufacture of crude materials, barrels, cans, paints, glue, acids, &c., necessary in their business; and in some cases organized corporations for the purpose of such manufacture. They became particularly interested in the matter of transportation; and the stockholders of the various companies, as individuals, constructed pipe-lines for carrying petroleum to the seaboard at the expense of millions of dollars, and held their interest as partners until corporations were established. It was the aim of these men to open markets for American petroleum. In order to introduce it into home and foreign markets, their energies and capital were directed to the making of safe and efficient illuminating oils, and to the cheapening of the manufacture, not only of the products of petroleum, but also of all the materials used in its manufacture and transportation. On the 2nd of January, 1882, the number of persons thus associated in carrying on the oil business in its different branches through the agency of corporations organized by themselves for that purpose was 40. They owned the entire capital of 15 corporations, and part of the stocks of a number of others; the latter being principally small companies engaged only in trading in oil. Of the stocks thus held, nine persons owned a majority; and, in consequence, they could cast the controlling vote in each corporation. These persons entered into an agreement by which all their stocks were placed in the hands of the nine persons owning the majority as trustees. The trustees issued certificates showing the extent of each person's interest in the stock so surrendered, and agreed to endeavour to have the business of the several corporations conducted for the best interests of all concerned. It will readily be seen that this Trust did not unite competing corporations, for the corporations were largely organized as contributory agencies for the same business. The stocks were owned by persons who had long been united in building up and carrying on this business; and the voting power was then held, and continued to be held until the dissolution of the Trust on March 21, 1892, by the persons named as trustees by right of absolute ownership of a majority of the stocks. One effect of this Trust is apparent in the fact that during the ten years of its existence, the number of persons holding its certificates increased from 40 to 2000. Every clerk, agent, and employee in the various corporations, who could save a few hundred dollars, purchased Trust certificates, and thus became interested in the business and profits.

Until 1872, but little progress had been made in the oil business. The methods of transportation and manufacture were expensive; and the product was poor, even at the high prices obtained. The business of refining was not financially successful. It was about that time that the men in control of the Standard Oil Company began to enlarge their business, to enter into association with refiners at other places, and to use the greater capital, experience, and instrumentalities thus obtained in improving and cheapening the methods of manufacture, the quality and cost of the products, the system of transportation, and in opening markets in foreign countries. The effect upon the business was soon apparent. In 1872 refined oil at wholesale averaged 23·5 c. per gallon. The output was about 248 million gallons, and the value of the exports at that price, $34,000,000. The improvement in production and price from that date has been gradual and marked. In 1890 the output was 13,027 million gallons; the average price, 7·3 c. per gallon; and the value of exports at that low figure, $51,500,000. The reduction in price between 1872 and 1891 was 16·2 c. per gallon, which shows $215,000,000 per annum saved to the public by reduction of price. Crude petroleum averaged $4 per barrel of 42 gallons in 1872, and $0·87 per barrel in 1890; so that $99,000,000 of this annual saving is attributable solely to the reduction in the crude product, consequent upon its enormous production. The remaining $116,000,000 per annum of saving is the result

solely of cheapening the price of the manufactured products. This reduction has been accomplished in various ways. At first, oil was barrelled and transported from the wells to the refineries or railroads in waggons, and then by rail to the seaboard. The system of transporting by pipe-lines was introduced prior to 1872; but it was expensive and inefficient. The Standard interest systematized and enlarged the local system, and continued the lines to the principal cities of the seaboard. Thousands of tanks were erected to hold the surplus production, and as much as 1500 million gallons of surplus oil have been stored in these tanks at one time. Pipe-lines have been built to New York, Philadelphia, Baltimore, Buffalo, Pittsburgh, Cleveland, and Chicago; and a network of feeding lines reaches from the wells to connect with the main lines. If these lines were laid continuously, they would encircle the globe. When the producer of oil puts down a well, he notifies the pipe-line company, and immediately a line is laid to connect with his well. The oil is taken from the tank at the well, whenever requested, into the large storeage tanks of the Company, and is held for the owner as long as he desires it. A certificate is given for it, which can be turned into cash at any time; and when sold, it is delivered to the purchaser at any station on the delivery lines. A new oil-field was discovered last summer near Pittsburgh; and in three months the production was 70,000 barrels per day. Yet pipe-lines and storeage-tanks were built so rapidly that this enormous product was handled with scarcely any waste. The lines to New York deliver to the refineries at Long Island City and Bayonne 1,250,000 gallons per day. This is manufactured into a great variety of products; the principal one being illuminating oil. Some of the illuminating oil is barrelled for local trade, some is shipped to other points in tank-cars made for the purpose, and some is placed in tin cans boxed in pine for the Oriental markets; but the greater part is pumped directly from the refineries into steamers carrying oil in bulk, and thus shipped to European ports, there to be pumped into huge tanks for further distribution by tank-cars and tank-waggons. The capital invested in these pipe-lines, tank-cars, and tank-steamers is more than $50,000,000. By this system, oil can be placed at the seaboard and on tank-steamers at less than the cost of a few miles of waggon transportation under the old system. The importance of this method of transportation cannot be over-estimated at the present time. In Russia, wells pour forth petroleum in almost unlimited quantities, and its price at the wells is less than 5 c. per barrel. Their system of refining and marketing is copied from the American. The capital employed is large, and Russia is striving for the markets of Europe and the East. They already dispose of 1200 million gallons of the crude product per annum. Were it not for our pipe-line system, our tank-steamer system, and our cheap methods of refining and of manufacturing all necessary materials, we could not hold the export trade for a single year. This system could not have been built up without a combination of persons and capital.

The actual cost of refining has been reduced since 1872 about 66 per cent. This has been accomplished partly by the discovery and use of better processes and better machinery, partly by the elimination of the waste once incident to the business, and partly by the refiners manufacturing for their own purposes and cheapening the cost of the materials used in manufacturing oils. Residuum was formerly used for fuel; now it is made into paraffin wax and lubricating oils. Naphtha was once little better than a waste product; now, as a component of gas, it lights the great cities of the land. Sulphuric acid is largely used in refining, and formerly cost $1·25 per 100 lbs.; the Standard manufactures its own at a cost of 8 c. per 100 lbs. In 1872 barrels cost the trade $2·35 each; the Standard manufactures them now at a cost of $1.25 each. As 3,500,000 barrels are used per annum, this item of saving amounts to $4,000,000 per year. Tin cans are now manufactured by the Standard at 15 c. less per can than they cost in 1874. As 36 million cans are used per year, this saving amounts to $5,400,000 annually. Thus I might speak of paint, glue, tanks, stills, pumps, and pipes. Almost everything used in the oil business is manufactured by some of the corporations which were created for the particular purpose. While the price of oil has thus been lowered, competition has not been destroyed, but it is vigorous and effective. Thousands of workmen and persons of small capital are sharing the profits of the business; the wages paid are above the average; and American petroleum is holding its place in foreign markets. Association was necessary to accomplish these results, as it is to accomplish any great business end.

The Hemsworth Water Provisional Order.—At a meeting of the Hemsworth Union Board of Guardians last Thursday, a communication from the Local Government Board was read by the Clerk, relative to the Authority's application for a Provisional Order to empower them to obtain water from Dewsbury. The Board intimated that Sir Richard Webster, whose opinion had been taken on the matter, had advised that the Dewsbury and Heckmondwike Water Board had no power, under their present arrangements, to sell to other districts as proposed, so that the Order would be left in abeyance.

Gas-Meter Testing in Manchester.—The Official Inspector of Gas-Meters for Manchester (Mr. J. Urquhart) has just presented to the City Justices his report for the year ending March 31 last. He states therein that in the twelve months he tested 11,346 meters, as compared with 10,675 in the previous year; being an increase of 671. The fees charged amounted to £408 19s., against £406 15s. 7d.—a gain of £2 3s. 5d. The small advance is owing to the meters tested being of a uniformly smaller size than usual, for which lower fees are charged. The Inspector's cash statement of revenue and expenditure shows a net loss of £301 19s. 7d. on the year's work. This is less by £30 19s. than the loss in the previous year. Of 11,346 meters tested, 485 were rejected; being equal to 4·27 per cent., against 4·26 per cent. in 1890–91. This total consists of 50 new wet meters, or 1·06 per cent., 137 old ones, or 3·08 per cent., 6 new dry meters, or 0·48 per cent., and 292 old ones, or 30·48 per cent. of the entire number tested. Rejected wet meters show an average of error, in excess of the legal limit, equal to 4·5 per cent. if fast, and the same if slow. In the case of dry meters, the average excess is 2 per cent. if fast, and 8 per cent. if slow.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Perth Gas Commission are the first of the large gas-owning bodies in Scotland to publish the financial results of their past year's working. Their year closes on April 30; and within three weeks they are able to announce their balance, which is very smart work. The total revenue was £18,859, of which £17,316 was from gas. The total expenditure was £17,010; leaving a balance of £1848. Out of that sum, £1000 requires to be placed to the sinking fund, £100 is taken to liquidate bad debts, and £52 to make up the deficit which arose upon the previous year; and there is left a net surplus of £695. The revenue is £2026 greater than it was in the previous year, which is accounted for by the increase of 6d. per 1000 cubic feet of gas that was put on a year ago. There has, however, been a disappointment in the matter of residuals, which were expected to produce £1900, but have only realized £1084. The expenditure side is the most satisfactory; for whereas it was estimated that the surplus would be £364, it is actually £695. The total expenditure was only £342 higher than it was in the previous year. So far as can be seen, the whole of the saving in the outlay has arisen upon the coal account. The estimate for coal was £8389; and the actual outlay was £8034. Should the Commissioners be able to secure their coal contracts at a lower rate this year, there does not seem to be any reason why they might not find it within their power to grant a reduction in the price of gas.

The Directors of the Stonehouse Gas Company, Lanarkshire, have appointed Mr. Walker, of Duns, Manager of their works.

Messrs. Hanna, Donald, and Wilson have secured the contract for the construction of a new gasholder at the Wishaw Corporation Gas-Works.

Gas companies having now worked their financial year, are beginning to hold their annual meetings. The shareholders of the Strathaven Gas Company met this week. The report of the Directors to them was that the working for the year had resulted in a profit of £44, which was a long way short of previous years. The Company fortunately possesses a reserve fund; and, like other companies of much larger dimensions, it was resolved to draw upon it in order to pay the customary dividend of 7½ per cent.

The Stonehaven Gas Company held their annual meeting on Monday. The profit for the year was £357, which was £277 less than in the previous year. The customary dividend of 2s. 6d. per share was paid. This year there is to be some expenditure on the works; and this, with the price of coal, makes it doubtful whether the Company will be able to go on without raising the price of gas. In the year just closed, the Directors have had considerable encouragement; the sale of gas having been much higher than in any previous year.

The Burntisland Gas Commissioners have entered into contracts for the supply of coal for the present year at an average price of 19s. 5d. per ton. Last year the average price was 21s. 2½d. per ton. The coal is selected with a view to producing gas of 26½-candle power.

The Corporation of Glasgow have already got into a small trouble, which may, however, be a source of annoyance to them again, over their electric lighting station. The Deputy-Town Clerk was on Wednesday summoned to the Central Police Court on a charge of allowing black smoke to issue from the furnaces at the electric lighting station in John Street. In imposing a fine of 40s., the Magistrate gave expression to the reminder that the Corporation, who were endeavouring to have the penalties for smoke nuisances increased, should be the first to set an example to others. Of course, it is easy to give a magisterial rebuke, and no one will say that it was undeserved in this instance; but it is quite another matter to find a remedy. The electric lighting works are new; and the plant is, in the matter of extent at least, in a large measure experimental. It is likely that, if the business gets consolidated, so will the plant; and experience will teach how many things may be done which are not very well understood as yet. Meantime, the Corporation are, under this conviction, obliged to desist, or to stand the risk of being fined again.

In Glasgow at present the Corporation are considering the question of taking over the tramways; and in connection with it, the subject of motive power is being taken up by some. The horse is not liked by anyone; neither is the steam tramway locomotive. The cable system is objected to by many, on account of the third line of metal in the street. As for electricity, except at Leeds it has not shown itself to be a reliable and profitable source of motive power. Councillor Crawford, of Glasgow, has been to Dresden inspecting a gas motor for tramways which is being experimented upon there. He seems to be favourably impressed by it. I do not know what the Dresden motor is like; but I recollect that some four or five years ago Mr. J. M. Turnbull, of Rose Street, Edinburgh, read a paper before the Royal Scottish Society of Arts, in which he described a continuous oil-gas plant which he recommended as suitable for both the lighting and driving of such vehicles as tramcars, launches, &c. Mr. Turnbull, however, does not seem to have followed up his invention.

The Glasgow Town Council, sitting as Water Commissioners, transacted some important business on Wednesday. They first of all agreed to fix the rates for water for the current year the same as they were last year—viz., 6d. in the pound within the city, and 10d. outside, with a public water-rate of 1d. in the pound. Satisfaction was expressed that, notwithstanding the large outlay upon the works connected with the augmentation of the water supply—£120,000 having been added to the capital account during the past year—it had not been found necessary to raise the rates. The next item of business consisted of claims by the County Councils of Perth and Stirlingshire, amounting to nearly £900, as compensation for outlay upon roads in the districts where the extension works are going on, caused by the extra traffic to and from the works; and these, subject to adjustment, were agreed to be paid.

Professor Kennedy seems, so far, to have secured all the patronage which is going in Scotland in the matter of electric light consultation. He was in Aberdeen last Saturday inspecting the town with a view to giving his advice to the Corporation Gas Committee as to how they are to proceed in the introduction of their installation. The Professor, like all the others of his class, has a system—in his case, it is the

low-tension three-wire system—and he finds it to be suitable for the district he is advising upon. It was so in Glasgow and in Dundee; and now, as expressed in an interview he had with the Gas Committee, he finds that Aberdeen and Glasgow, so far as a system of electricity is concerned, are much in the same position. Aberdonians usually get credit for shrewdness; and this quality was conspicuous at the interview. They were not content with Professor Kennedy's statement of the situation; but wanted to know whether he thought a Corporation installation would be likely to pay working expenses. His answer was very guarded. He thought that, looking to the size and number of the shops within the area scheduled, and their clean and tidy appearance, proprietors would not hesitate to take the electric light because of its being so much better and cleaner for their goods. This being so, the installation should be in the hands of the Corporation, and they should charge a less price than was authorized by their Provisional Order. It will be observed that he did not answer the question; but that in the opinion he gave, he favoured the installation having the city rates behind it, which, to those who can read between the lines, ought to be evidence that he does not think an electric lighting installation would pay in Aberdeen. A curious part of his opinion was that he did not favour street electric lighting in a town like Aberdeen. Why? one is tempted to ask. What is the difference between Aberdeen and (say) Glasgow or London in that respect? The Gas Committee asked him to furnish them with a report as to the most economical site, the system of supply and distribution, and the cost; and perhaps in his report he may state why he thinks the Corporation of Aberdeen should not have the advantage of the advertisement which street lighting is supposed to be.

The Dundee Gas Commission met on Tuesday to consider Professor Kennedy's report upon the plans for their electric lighting station. The document was gone over minutely; and the Commissioners are now advertising for tenders for the work. It is intended to proceed first with the laying of the street mains, as these will take more time than the other parts of the work. The work is divided into six different contracts—boilers, steam-piping, steam-engines, dynamos, accumulator batteries, and street mains.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 21.

Sulphate of Ammonia.—The depression of the market is precipitated by the collapse in the price of nitrate; and spot parcels are now difficult of sale. Consumers seem to have withdrawn entirely, leaving the field to the dealers, with obvious results. The shipments, especially from here, furnish evidence of demand, but which has been satisfied by speculative sales some time ago. Had such a state of things supervened in the earlier part of the year, it might have been a source of danger; but, with the smaller production and fewer parcels offering, the consequences need not be serious. The quotations are now generally below £10; but whether £9 17s. 6d. or £9 15s. is the correct figure according to real transactions, it is not easy to ascertain. Nitrate has fallen to 8s. per cwt. on spot—cargoes off coast being actually offered at 7s. 9d.; and buyers seem disinclined to grant even this figure. It is generally anticipated that nitrate will come lower still.

LONDON, *May* 21.

Tar Products.—There is a little better feeling in this market; and business in benzol has been done at 1s. 7d. for 90's. Crude carbolic acid has also been in better demand; and buyers seem now disposed to book their requirements for a considerable period ahead. Anthracene is quiet at last week's rates; but considerable business is reported as having been done. Creosote is slightly better—some important railway contracts being on the market; and this, with the lessened production, will no doubt stiffen the price. Pitch maintains its position. Prices: Tar, 10s. to 13s. Pitch, 27s. to 30s. Benzol, 90's, 1s. 7d.; 50's, 1s. 3½d. Toluol, 1s. 2d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B" quality, 7½d.

Sulphate of Ammonia.—This article seems to go from bad to worse; and £9 17s. 6d., less the usual discount, appears to be its present value, and for June delivery even lower prices are mentioned. Gas liquor (10-oz.) is quoted at 5s. to 6s. 6d.

Serious Gas Explosion at Richmond.—Last Wednesday morning, a shop in Kew Road, Richmond, which was in the occupation of Mr. Deeks, a grocer, was wrecked by an explosion of gas. It appears that some workmen in the employment of the Gas Company were engaged putting in a new and larger service-pipe from the main. Two were outside, working in a trench, and the third—a gas-fitter, named Cook—was at the back of the shop, and had a portion of the floor up. He asked for a light, and a candle was given to him by Mr. Deeks, jun., who requested him to be careful. The words were hardly out of his mouth before the explosion occurred. Considerable damage was caused to the shop and its contents; and Cook was severely cut and burned about the head.

Fatal Accident at the Bournemouth Gas-Works.—Last Saturday week, Mr. Harfield, the County Coroner, held an inquiry at Bournemouth into the cause of the death of John Hansford, who was killed on the previous day at the gas-works. It appeared from the evidence that between 10 and 11 o'clock in the morning, a horse was drawing a waggon of wet sand; and it was the duty of the deceased to stand and drop the tail-board as the waggon reached the tip. The horse's foot touched the deceased; and he stumbled and fell across the rails, and was instantly run over—one of the wheels resting on his back. He was at once extricated and taken to the hospital, where he died. The Resident Medical Officer (Mr. Wickham) stated that an examination of the body showed that the lower ribs had been broken, and there were also signs of severe internal injuries. The jury returned a verdict of "Accidental death."

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A steady slackening off in the demand generally is the report throughout the coal trade of this district; and although the best qualities suitable for house-fire purposes remain fairly steady at late rates, there is a weakening tendency in prices as regards other descriptions. Common round coals continue in only limited inland demand, for iron-making, steam, and general manufacturing purposes; whilst for shipment, inquiry is still very indifferent, and lower prices are being taken to effect sales. As regards inland sales, although list rates are nominally unchanged, colliery proprietors give way to meet customers, and steam and forge coal at the pit mouth scarcely averages more than 7s. 9d. to 8s. 3d.; whilst for shipment, steam coal is offered at from 9s. 3d. to 9s. 9d. per ton, delivered at the High Level, Liverpool, or at the Garston Docks. The depressed condition of the principal coal-using industries is necessarily causing exceptional anxiety with regard to the course of prices when the approaching renewals of gas coal and locomotive fuel come forward. It will be remembered that last year there was a substantial giving way in prices, as compared with those obtained in the previous year; and if the reported renewal of one of the large railway contracts could be taken as indicating the probable course of prices, it would seem likely that still more substantial concessions will have to be made this year. Although there is no absolute official information to the effect, there is an apparently well-authenticated report in the market that this contract has just been renewed on the basis of 7s. 3d. per ton at the pit—representing a reduction of 9d. per ton upon the price obtained last year; and this is regarded as not foreboding any very satisfactory outlook for colliery proprietors in respect to the renewal of the other contracts which will shortly come forward. With regard to engine classes of fuel, although the re-starting of the mills throughout Lancashire is necessarily moving away larger quantities, there is no improvement so far as prices are concerned. Some of the colliery proprietors are holding firmly to late rates; but there are low sellers in the market, and plentiful supplies generally. At the pit mouth, burgy averages 6s. 3d. to 6s. 9d.; best slack, 5s. to 5s. 3d.; with common sorts offering at 3s. 3d. to 3s. 6d. per ton.

Northern Coal Trade.—There is more coal now offering in the North, several of the non-associated collieries having been opened at reductions on the rate of wages, whilst others are likely to follow; and it is evident that the end of the long strike is near. This increase of local coal has been followed by a slight ease in the price; and generally there has been a tendency to sell, whilst buyers needed concessions. Best Northumbrian steam coal is quieter than it has been, in consequence of the increased output of Durham coal; and now the price for prompt delivery may be put at from 11s. 6d. to 11s. 9d. per ton, f.o.b. But for forward delivery much lower rates are offered. Small steam coal is easier; and about 7s. per ton represents the highest current quotation. Gas coal is now rather difficult to quote; there is a small production from some of the Durham pits, and Scotch coal is freely offered. But for forward contracts—that is, for delivery after the general commencement of the Durham pits—quotations are now being made at from 8s. to 9s. per ton, f.o.b. A few weeks, however, will be needed to allow the tendency of the trade and the probable prices to show themselves. Household coal is flat. For Yorkshire supplies, as high as £1 per ton has been paid; but these will soon be out of the market, it is quite expected. Bunker coal is dull and likely to decline. Coke is still scarce, though a few ovens are already at work after a long stoppage. Gas coke is steadier in price, many of the stocks having been exhausted; whilst the production now is generally very small, and will decrease for the rest of the month.

Scotch Coal Trade.—The prolongation of the Durham strike, coupled with the fact that the miners in Scotland are very strictly adhering to the advice given to them to restrict the output, keeps up an appearance of activity all round. The demand is quite equal to the supply; and coal-owners are unwilling to take forward orders, not knowing what troubles may be in store for them. There is an impression that the miners will not stand any more reductions; and when the North of England coal market again comes into competition, which must be soon, there may be complications, as it is likely that the demand in Scotland will fall off, and it may be necessary to try a further reduction of wages. Gas coal is in demand, which is probably another reason why coal-owners are showing a disposition to stiffen their prices for long contracts. For immediate delivery there has been little fluctuation in prices. The figures quoted per ton are: Main, 7s. 6d. to 7s. 9d.; ell, 8s. 6d. to 8s. 9d.; and steam, 10s. to 10s. 3d. For the previous week, the shipments amounted to 184,035 tons—an increase of 14,000 tons over the preceding week, and of 29,839 tons over the corresponding week of 1891; while for the year they have been 2,474,415 tons, an increase of 317,710 tons.

Fatal Accident at the Birkenhead Water-Works.—A terrible accident occurred last week at the Wirral Water-Works, at Birkenhead. It appears that a number of men have been employed for some considerable time at the well at the works, which is upwards of 200 feet deep and about 40 feet in circumference. On the day of the accident, two men, named William Jones and Benjamin West, proceeded to descend the well in a tub fastened by three thick chains, and attached to a wire hawser, which was connected to a steam winch. When about 80 feet down the well, the winch by some means got out of order; and this caused the tub to jerk and sway about, and then strike a girder in the wall. The shock was so great that West was precipitated headlong down the enormous cavity. Meanwhile Jones managed to recover himself, and held fast to the tub till he was hoisted to the surface, when it was found that he was only slightly injured. The Water Engineer (Mr. W. A. Richardson) and his assistant (Mr. Nash) were sent for, and were quickly on the spot. The body was not recovered for about two hours; and when it reached the surface, it was found that his head was fearfully bruised and cut in several places, and also his chest. A medical gentleman examined the body, and pronounced life extinct.

Odessa Water Company.—The water-rents of this Company for the year 1891 amounted to £52,952, against £50,941 for 1890, and the miscellaneous receipts to £5186, against £3313; leaving a balance, after meeting interest on debentures and all charges, including drawn bonds, of £12,662, against £8555 for 1890. This balance includes the profit of £1472 on exchange.

The Proposed Purchase of the Mexborough and Swinton Gas-Works by the Local Authorities.—A conference took place last Friday between members of the Local Boards of Mexborough and Swinton as to the desirability of purchasing the local gas-works. The question was fully discussed; and there appeared to be a general opinion that it might be in the interests of the two townships to effect a purchase if the price asked for the concern was not prohibitive, taking into consideration the years that the works have been in operation, and the substantial outlay that would be needed in order to put the gas-mains, &c., in a more satisfactory state. It is understood that the Directors of the Company will consider the matter; and that it will then come up for further debate between the Local Boards.

An Electric Lighting Scheme for York.—At a special meeting of the York City Council held last Tuesday, a report was presented from the Streets and Building Committee on the subject of the proposed introduction of an electric lighting scheme. The Council have already obtained a Provisional Order for the purpose, which will lapse if the powers contained therein are not exercised before August next. Mr. Crompton, the Electrical Engineer of the Corporation, prepared an estimate for an installation for £10,000; but as the area was extended by the addition of other streets, the figure was afterwards raised to £12,000. The Council have had applications for 2700 lights; and they themselves will require about 2500 more. The Committee recommended the Corporation to borrow £15,000; and, after a long discussion, this was agreed to—not, however, without some opposition. It appeared to be the opinion of certain members of the Council that it would be preferable to hear what electric lighting contractors would be prepared to do before coming to a decision; but an amendment expressing this view, and referring the report back to the Committee, was lost by 15 votes to 8. The Council will therefore retain control of the scheme.

The Supply of Water to High Levels.—In the Queen's Bench Division a few days ago, Justices Day and Charles had before them a special case stated by the Justices of Barnstaple, in reference to the construction of the Act under which the Barnstaple Water Company carry on their operations. It was the result of certain proceedings taken by the Company against a consumer in March last, as reported in the JOURNAL at the time (*ante*, p. 500). The consumer's premises were situated between two reservoirs belonging to the Company—one called the Raleigh, and the other the Pickard Down reservoir. They were above the former reservoir, and could not possibly be served by gravitation from it, but only by pumping; but the Pickard Down reservoir was above the level of the premises, and water could be supplied by gravitation in the usual way. But the Pickard reservoir was filled from the Raleigh reservoir by pumping; and as the Act of Parliament under which the charges were made provided that one-fifth more than the rate authorized to be charged should be levied on all premises where the water could not be supplied by gravitation, the question arose whether the owner was liable for this extra rate. Another point was that at the time the Act was passed in 1888 only the Raleigh reservoir was in existence. The words of the Act provided that the extra charge should be made in cases in which the Company supplied water at a pressure greater than that afforded by gravitation, either from the then existing reservoir or from any other reservoir. This, Mr. Asquith, Q.C., contended, on behalf of the Company, made the respondent liable. At the conclusion of the argument, it was stated that Mr. H. F. Dickens, Q.C., who had been retained for Mr. Tucker, the consumer, was engaged in another Court, and was unable to reply. Mr. Justice Day said he could not help that. He had come to the conclusion that the appeal must be allowed, with costs; but as the case had not been argued from the other side, he would give leave to further appeal.

The West Bromwich Gas Undertaking.—The Secretary of the West Bromwich gas undertaking (Mr. T. Hudson) has just issued his report for the year ending March 31 last. It states that the borrowing powers of the Corporation with respect to the undertaking are for only £174,955; but application has been made to the Local Government Board for an extension of them, to enable the Gas Committee to carry out certain projected improvements in the works and plant. The amount spent on capital account during the past year was £1300. The total expenditure on this account is now equivalent to £8 1s. 3d. per ton of coal carbonized, or £806 2s. 7d. per million cubic feet of gas made. The report states that the year just closed was one of much anxiety, owing to the continued high price of coal. As a result of this and other increased expenditure, the profits of the undertaking for the year were again much lower than formerly. The sales of gas showed a slight increase; the income from private consumers and from public lighting being £25,823, or £283 more than in the preceding year. This increase is stated to be entirely due to new consumers; the number being upwards of 100 in excess of the previous year, and these almost entirely small consumers, supplied at 2s. 8d. per 1000 cubic feet—a fact no doubt due to the abolition of the deposit system. As mentioned in the JOURNAL last week, the total quantity of gas consumed was 203,780,700 cubic feet—an increase of nearly 2½ millions. The income from coke and breeze was £8177—a rise of £399, due entirely to increased production. The revenue from gas-fittings and stoves was £1451—an advance of £38; but the increased expenditure more than covered this. The total income for the year from all sources was £37,799—an increase of £728. The total expenditure is £29,289—an addition of £1484, caused chiefly by increased expenditure on coal, and also by a larger amount having been expended on maintenance, repairs, and renewals. The net cost of raw material was £14,377—an increase of £964. The wages amounted to £3140; and the expenses of management were £1062. The balance of income over expenditure was £8510—a decrease of £755. The amount in hand at the commencement of the year was £9247, out of which £1000 had been employed in the relief of the general district rate.

Artesian Wells in Spain.—Eight artesian wells have been opened by the Salonica Water Company, five of which are already in working order, and supply together 5,364,000 gallons of water in 24 hours. The contract of the Company compels them to furnish only 2,200,000 gallons of water per day to the town.

Compensation for Injuries to a Coke Filler.—In the Queen's Bench Division of the High Court of Justice on the 14th inst., before Mr. Justice Grantham and a common jury, a labourer named Barrable sued Messrs. Hillman and Co., carmen and contractors, for compensation for injuries suffered in an accident which happened on April 17 last year. The plaintiff was working a machine for filling sacks with coke at the Commercial Gas-Works, Wapping. The defendants had a contract to cart coke from the works to St. Katherine Docks; and it was said that a servant of theirs backed a van against the plaintiff's machine, knocked it over, and crushed three of the fingers of his left hand. The defendants denied that there was any negligence on their part; and asserted that the plaintiff showed want of care in standing where he did. It was also said that the carman was at the time acting under the direction of William Hawley, a fellow-servant, in the course of their ordinary employment. The jury gave a verdict for the plaintiff for £15.

The Bradford Corporation Water Supply and Lead-Poisoning.—A conference of Medical Officers of Health for the out-townships deriving their water supply from the Bradford high-level service was held last week to consider the prevalence of lead-poisoning in the out-townships, and the best means of preventing it. A series of resolutions to the following effect were unanimously approved, after a discussion lasting for more than two hours: That a lead-contaminated drinking water supply is a grave danger to public health, and that wherever plumbism develops in such a supply the local sanitary authority should regard it as an imperative duty to take all possible precautionary and preventive measures, regardless of expense; that where possible the character of the water should be modified, so as to reduce the plumbo-solvent action to the lowest possible limit, and that the use of lead service-pipes and fittings should be discouraged; and that the constant use of filters, such as the animal charcoal ones, should be adopted by householders. A strong opinion was unanimously expressed that the Bradford Corporation should be urged to so treat the high-level supply as to render the water no longer plumbo-solvent. An inquest was held at Wyke a few days ago on the body of Alfred Shackleton, whose death was caused, according to the medical evidence and the finding of the jury, by lead-poisoning produced by drinking water supplied to the inhabitants of Wyke by the North Bierley Local Board, and purchased from the Bradford Corporation.

Preston Corporation Water Supply.—The Borough Engineer of Preston (Mr. Hudson Reah) has recently prepared a lengthy report on the subject of the water supply of the town, in the course of which he makes a number of recommendations. He says that it is absolutely necessary that an additional supply main should be laid from the reservoirs into the town; and he proposes that a 36-inch main (to which the existing 24-inch, the 16-inch, and the 14-inch mains will be connected) be laid, and connected with the present valve-house and screens at the west reservoir at Grimsargh, and also with the middle reservoir, where a new valve-house and screens would have to be constructed. This would very largely increase the supply, but not greatly the pressure; and to meet the numerous and increasing complaints as to inadequate pressure, Mr. Reah recommends that the proposed main should be continued to Alston reservoir, where a valve-house and large screen and straining appliances would have to be erected, into which the water from Alston reservoir would pass through an iron pipe. The scheme, however, would interfere with the working of the reservoirs at Grimsargh, as, owing to the higher altitude of the Alston reservoir, the water would be unable to flow out of the Grimsargh reservoir when that at Alston was being used. There are, however, two ways of dealing with the Grimsargh reservoirs—that is, either to make two water districts in the town, the one to be supplied by the 26-inch main and the Grimsargh reservoirs, and the other by the proposed new 36-inch main and the Alston reservoir, the mains being connected so that either would be available; or the town could be kept in one water district, as at present (which would be much the cheaper and easier to work), and the Grimsargh reservoirs, with the 26-inch main kept as a reserve, and used in case of accident to the Alston main, or at times when the higher pressure was not needed (as at each week-end), or at any other time it was deemed desirable. Mr. Reah also asks that the inadequate storeage be also considered. The Langden and Hareden brooks yield an average daily supply of over 3,500,000 gallons; and the estimated daily yield of the Cowley brook is 1,500,000 gallons. During the very hot, dry weather of 1887, 4,168,775 gallons of water were sent into the town in 24 hours from the west reservoir at Grimsargh. This was exceptional; and the average daily quantity was, he estimates, about 3,000,000 gallons. A considerable quantity of water is available if there is proper storeage. The storeage capacities of the Spade Mill, Alston, and Grimsargh reservoirs totals to 253,390,354 gallons. As he considers large storeage accommodation absolutely necessary, Mr. Reah recommends that 27¼ acres of land belonging to the Corporation at Alston be cleared; and a reservoir capable of holding 275,000,000 gallons constructed. In order that water might be supplied to the town, certain alterations in the existing culverts would be necessary. The gross revenue from the water-works for the twelve months ending March 31, 1891, was £19,850; and the cost of constructing the various works recommended in the report is £95,500. It is interesting to note that the total capital cost of the water-works up to March 31, 1891, was £341,516, of which £21,291 has been provided out of the surplus revenue. The amount borrowed is, therefore, £320,225; and of this there has been repaid £28,227—leaving the sum of £291,997 owing on water-works account on March 31, 1891. A reference was made by Alderman Maynard to the subject of the extensions at a recent meeting of the Council. The cost of the works, he said, would necessitate no addition whatever to the rates, nor any application to Parliament. The Local Government Board would give them permission to raise the money; and the interest and sinking fund would be paid out of the revenue derivable from the water. There would be sufficient revenue; and, therefore, the rates would not be called upon.

The Mansfield Water Question.—Mr. T. Hawksley has been selected by the Mansfield Town Council to report upon the water-works schemes which have been laid before them.

The Purchase of the Calverley Water-Works by Local Authorities.—The Farsley Local Board have decided to confirm an agreement entered into with the Pudsey and Calverley Boards with respect to the purchase of the Calverley District Water-Works Company's plant and undertaking.

The Kirkleatham Water-Mains Arbitration.—Mr. Henry Law, the Arbitrator appointed to fix the price to be paid by the Kirkleatham Local Board to the Stockton and Middlesbrough Water Board for the purchase of the pipes, mains, &c., in the district to be taken over by the former, has re-stated his award at the sum of £8006. The arbitration and subsequent proceedings in regard to this matter were noticed in the JOURNAL for Jan. 26 and Feb. 9 last.

The Carriage of Petroleum in Bulk through the Suez Canal.—Sir F. Abel and Mr. Boverton Redwood, who have, at the request of British shipowners, been investigating the subject of the transport of petroleum in bulk through the Suez Canal, have issued a report, in which they express an opinion that, even with the strict enforcement of proper regulations, the passage of tank steamers laden with oil must involve risk to other shipping using the water-way. The high temperature of the atmosphere on the Canal during a large part of the year, and also of the water itself, is, in their opinion, likely to increase considerably the risk arising from an outbreak of fire and of explosions of a mixture of petroleum vapour and air on board the vessel. In the case of the escape of petroleum through leakage, collision, or grounding, the prevailing high temperature, and also the necessary employment on the Canal of many lights, some of them gas-buoys placed in the water, would make ignition of the floating oil almost certain. The regulations issued in regard to this class of traffic by the Suez Canal Company are considered inadequate in various ways, and especially in respect that the Company take no responsibility for their enforcement. With proper stipulations as to the construction of tank vessels, and rigid regulations affecting them during their passage, the authors admit that the risk might be to some extent reduced.

Paraffin Lamp Accidents.—Early in the morning of Monday, the 9th inst., a fire broke out in New John Street, Birmingham, which did little damage to property, but by which six men were more or less seriously injured. It had been caused by the ignition of the oil vessel of a paraffin lamp. Nobody was in the room at the moment, and the flames were first seen by a passer-by, who forced an entrance, and threw the lamp out into the street. It fell among the crowd which had gathered; and the blazing oil was scattered, as if from a bomb, upon the faces and hands of six men and youths, four of whom were treated for burns at the General Hospital, and two by the Fire Brigade. On Wednesday, the 11th inst., Dr. Danford Thomas held an inquiry at the Marylebone Coroner's Court into the circumstances attending the deaths of Mary Ann Flood, aged 40 years, wife of a jeweller, and Avis Bradley, aged four years, daughter of a tailor, both of whom lost their lives in a fire which took place at 50, Union Street, Marylebone, on the previous Saturday night. Flames being noticed at the window on the second floor of the house in question, the premises were entered, and the deceased woman was found lying on the floor. She was removed to the Middlesex Hospital, where she died. James Knightly, Engineer of the Metropolitan Fire Brigade, said he went into the room and found the deceased child lying face downwards on the floor, dead. It had in one hand the brass burner of a paraffin lamp. He examined the room, and found that the lamp had been taken down from its place (no doubt by the woman), and that the fire had been caused by the lamp exploding or being upset. The medical evidence showed that in both cases death had resulted from suffocation and burns. The jury returned a verdict of "Accidental death."

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 963.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½—17½	..	6 0 0
100,000	10	,,	7½	Do. 7 p. c.	10	11—12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	10—12	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6½—6¾*	..	5 11 1
40,000	5	,,	7½	Do. New	4	4½—5*	..	6 0 0
380,000	Stck.	26 Feb.	12½	Brentford Consolidated	100	210—215	..	5 14 1
150,000	,,	,,	9½	Do. New	100	162—167	+2	5 10 9
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
888,500	Stck.	11 Mar.	5	Bristol	100	95—100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42—44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	14½—15½	..	5 9 8
328,750	10	,,	—	Buenos Ayres (New) Limited	10	6½—7½	−½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94—97	..	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	13 Apr.	13	Commercial, Old Stock	100	229—234	..	5 11 1
165,000	,,	,,	10	Do. New do.	100	186—190	..	5 5 3
130,000	,,	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118—123	..	3 13 2
800,000	Stck.	30 Dec.	13	Continental Union, Limited	100	220—225	−1	5 15 6
200,000	,,	,,	10	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	30 Mar.	10	Crystal Palace District	100	185—195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19—20	..	5 0 0
354,060	10	,,	10	Do. Partly paid	7½	13½—14½	..	5 3 11
5,470,820	Stck.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	210—214	−3	5 12 1
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	94—97	..	4 2 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	247—252	..	3 19 4
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	116—121	..	4 2 9
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	169—174	..	4 6 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	153—156	..	4 9 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	245—250	..	4 0 0
476,000	,,	,,	—	Do. K, 6 p. c. Prf.	100	146—150	..	4 0 0
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	114—116	..	3 9 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	118—123	..	3 13 2
908,000	,,	,,	6	Do. 6 p. c. do	100	165—169	..	3 11 0
3,800,000	Stck.	12 May	12	Imperial Continental	100	217—221*	−1	5 8 7
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4—4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5p. c. Deb.	100	108—110	+1	4 10 11
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14½—15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8—8½	..	5 17 8
60,000	5	30 Mar.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2—3	..	—
				People's Gas of Chicago—				
420,000	100	3 May	6	1st Mtg. Bds.	100	102–105*	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	103—106	..	5 13 2
150,000	10	15 Oct.	10	San Paulo, Limited	10	8—9	..	—
500,000	Stck.	26 Feb.	15½	South Metropolitan, A Stock	100	275—280	..	5 10 8
1,350,000	,,	,,	12	Do. B do.	100	220—224	+1½	5 7 2
200,000	,,	,,	13	Do. C do.	100	235—240	..	5 8 4
725,000	,,	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	142—146	..	3 8 6
60,000	Stck.	11 Mar.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
729,331	Stck.	30 Dec.	10	Chelsea, Ordinary	100	252—257	..	3 17 9
1,720,252	Stck.	13 Apr.	8	East London, Ordinary	100	196—201	+1	3 19 7
544,440	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136—140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	98—102	+2½	3 18 5
708,000	Stck.	12 Feb.	10½	Kent	100	255—265	..	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	220—225	..	4 4 5
406,200	100	,,	7½	Do. 7½ p. c. max.	100	187—192	+2	3 18 1
279,700	Stck.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120—123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares	100	325—335	+5	3 12 4
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk	100	126—129	..	3 2 0
902,300	Stck.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	145—150	..	4 6 8
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	133—138	..	5 14 3
1,155,066	Stck.	11 Dec.	10	West Middlesex	100	243—247	−1	4 1 0

*Ex div.

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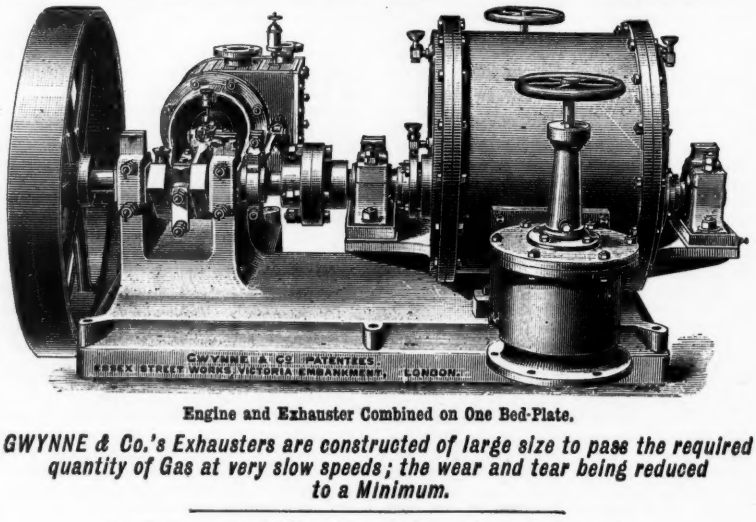

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Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKE CAN DO THIS.

Makers of GAS-VALVES HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

WINKELMANN'S "Volcanic" Fire CEMENT. (Fire resistance, 4500° Fahr.)
Prices, particulars, and directions for use on application to ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH. Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

OXIDE OF IRON FOR GAS PURIFICATION.

JAMES GORDON & Co., Brokers, can offer Cargoes of good quality; also 2500 tons of SPENT OXIDE.
Samples and price on application.
Address Borough Buildings, 7, Rumford Street, LIVERPOOL.

LIQUOR and Tar wanted.
BROTHERTON AND Co., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

LIQUID FUEL.

TAR Oils, Naphthalene, Oil Residues, Tar, Petroleum, &c. SADLER'S PATENT BURNER is the simplest and most effective. No smoke; no Ashes.
For particulars and price of Burner and Cheap Oils, apply to SADLER AND Co., LIMITED, MIDDLESBROUGH.

BOG ORE.

SEVERAL Hundred Tons in fine dry condition for shipment at Londonderry,
Apply to S. M. MACRORY, Steam-Mills, LIMAVADY.

WANTED, a re-engagement by a competent GAS-FITTER. Used to House-Fitting, Heating and Cooking Stove Fitting, Meters, Fixing and Index Reading, and the general work of Gas-Works. London experience.
Address FITTER, 3, Legge Street, Newcastle, STAFFS.

DRAUGHTSMAN AND CLERK OF WORKS.

REQUIRED by the Advertiser an appointment as above. Has had considerable experience in designing and erecting Works. During the last Five years has been engaged in connection with the erection of one of the largest Provincial Works.
Address W. J. C., 49, Welbourne Road, TOTTENHAM.

TEMPORARY Berth offered to an experienced Man of Mechanical ability, used to managing a small Gas-Works.
Apply, at once, stating full qualifications and lowest wages, to No. 2103, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS-FITTER and Bellhanger wanted.
Apply to W. BATCHELOR, 35, Warwick Street, LEAMINGTON.

WANTED, an Assistant Draughtsman in the Gas Engineering Department. Must be able to take out Quantities, and estimate Weights correctly.
Apply, with references, stating age and salary required, to NEWTON, CHAMBERS, AND Co., Limited, Thorncliffe Iron-Works, near SHEFFIELD.

WANTED, a good, steady Gas Stoker, used to Shovel Charging. Preference given to one having a knowledge of Exhauster and Boiler. Wages, 28s. per week. Permanent situation to a suitable man.
Apply, stating age, whether married or single, with copies of recent testimonials, to W. HUGHES, Manager, Gas-Works, Eckington, near ROTHERHAM.

WANTED, a practical Working Manager for the Conway Gas-Works (annual make 5 to 6 million cubic feet), under the superintendence of the Borough Engineer. The person appointed must be thoroughly competent as a Stoker, and in the Carbonization and Distribution of Gas in all its branches, and will be required to enter upon his duties on the 6th of June next. Wages, 30s. per week, with good House and Garden, Coal, and Gas free.
Any further particulars may be obtained upon application to Mr. T. B. Farrington, Borough Engineer.
Applications to be sent in, with not more than three copies of testimonials of recent date, before Two o'clock on Monday, the 30th day of May inst., to Mr. T. E. PARRY, Town Clerk, CONWAY.
Borough Engineer's Office, Conway,
May 5, 1892.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 944 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

TUBES.

FOR Gas, Steam, and Water; Galvanized, White Enamelled, and Hydraulic Tubes, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Barnsley, Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 70, Wellington Street, GLASGOW; 58, Fountain Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

TO INVENTORS AND OTHERS.

PATENTS for Inventions Secured and TRADE MARKS REGISTERED throughout the World. Advice on all matters connected with the above. Handbook gratis on application.
J. C. CHAPMAN, C.E., Chartered Patent Agent, 70, Chancery Lane, LONDON.

WANTED, for a large Gas-Works, an experienced and thoroughly competent ASSISTANT. Age about 30; married preferred. He must be capable of taking the entire supervision of the Works in the absence of the Engineer or Foreman. Must be a strictly temperate man, and good Draughtsman, and understand the Testing of Gas for Impurities.
Wages to commence, £3 per week.
Apply, by letter, to No. 2102, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—From 150 to 180 tons of SPENT OXIDE.
Apply to the MANAGER, Gas-Works, Stretford, near MANCHESTER.

FOR SALE—Thirty-five 3-inch Cast-Iron Flange and Spigot STOPCOCKS, in first-class order.
Address No. 2100, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PURIFIERS FOR SALE.

THE Gainsborough Gas Company have FOR DISPOSAL, as now fixed at their Works, Four PURIFIERS, 12 ft. by 8 ft. by 3 ft. 6 in. deep, with Valves and 10-inch Connections.
Apply to FRANCIS A. GAMBLE, Secretary.

GAS-METERS FOR SALE.

THE Royal Agricultural Hall Company, Limited, Islington, have FOR SALE one 500-LIGHT DRY METER, and one 200-LIGHT DRY METER, which until recently have been used at the Hall, and are in good working order.
Apply to R. VENNER, Secretary, Royal Agricultural Hall Company, Limited, ISLINGTON.

GASHOLDER AND CONDENSERS FOR SALE.

THE Great Yarmouth Gas Company have FOR DISPOSAL a GASHOLDER, with Cast-Iron Tank complete; also a set of CONDENSERS in good condition.
Further particulars can be obtained on application to the Engineer.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

OLPHERT'S OXIDE.

FINEST Quality of Natural Bog Ore
Apply for particulars to the Sole Agent, Mr. THOS. L. ARCHER, Cathedral Chambers, Half Street, MANCHESTER.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

OIL for the "Wells" or "Lucigen" Lamps.
HARDMAN AND Co., Miles Platting, MANCHESTER.

COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. See Advertisement p. 988 of this week's issue.
Inquiries should be addressed to THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

DRAWINGS, Tracings, Specifications, Quantities, &c., prepared by an experienced Engineering Draughtsman. Plans of Works made, copied, or enlarged. Blue copies made. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. L. FEATHERSTONE, 173, Fentiman Road, LONDON, S.W.

FRIEDRICH LUX, Ludwigshafen am Rhein; and at No. 142, Great Portland Street, London, W.
LUX'S Gas Regulators for every consumption.
LUX'S single-stem Pressure-Gauges.
LUX'S Regulator for Gas-Engines.
LUX'S Gas-Balance.
LUX'S new Gas Regulator for Inverted Lamps and other Apparatus for Gas Lighting, &c.

THE Sharon Chemical Company, Ltd., Derby, are buyers of AMMONIACAL LIQUOR and Sellers of TAR and SULPHURIC ACID. They frequently buy, sell, hire, or let Railway TANK-WAGONS. Correspondence invited from persons interested.

CARBON.

THE Bute Docks Company have for DISPOSAL from 8 to 10 tons of good clean RETORT CARBON.
Apply to S. WARD, Manager, Bute Gas-Works, CARDIFF.

ACID.

WANTED, in quantities as required during the year, from 50 to 60 tons of SULPHURIC ACID for manufacture of good Grey Sulphate.
State specific gravity and gross price, subject to deductions for water and discount, delivered at Tongham Station, L. & S. W. R., addressed to the ALDERSHOT GAS AND WATER COMPANY, Victoria Road, ALDERSHOT.

BLACKPOOL CORPORATION.

THE Gas Committee are prepared to receive TENDERS for the supply of about 18,000 tons of COAL and CANNEL for the ensuing year.
Tenders, endorsed outside, to be sent to the Chairman by the 28th of May.
Particulars and Forms of Tender may be had on application to the undersigned.
JOHN CHEW,
Engineer.
Gas Office, Blackpool,
May 12, 1892.

GAS COAL.

THE Directors of the Leyland and Farington Gas Company are prepared to receive TENDERS for their supply of COAL (screened, unscreened, or nuts) from the 30th of June, 1892, for Twelve Months.
Quantity used, about 2000 tons per annum.
To be delivered free at Leyland Station in such quantities as required.
Sealed tenders, endorsed "Gas Coal," and addressed to the Directors, to be in by Monday, the 20th of June, 1892.
CHARLES ELLIOTT,
Secretary and Manager.
Leyland, Lancashire,
May 19, 1892.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Leyland and Farington Gas Company are prepared to receive TENDERS for the surplus TAR and LIQUOR produced at their Works for Twelve months from the 30th of June, 1892. Delivered free on Rail in Contractor's Tanks.
Coal carbonized, about 2000 tons per annum.
Sealed tenders, endorsed "Tar and Liquor," and addressed to the Directors, to be in by Monday, the 20th of June, 1892.
CHARLES ELLIOTT,
Secretary and Manager.
Leyland, Lancashire,
May 19, 1892.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

TAR-WORKS.

ADVERTISER wishes to Lease or Rent a small or medium-sized TAR or SULPHATE WORKS.

Apply, by letter, stating terms and particulars, to No. 2101, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TENDERS FOR GAS COAL.

THE Llandudno Improvement Commissioners invite TENDERS for the supply of not less than 4500 tons of COAL capable of producing a minimum of 9500 cubic feet of 17-candle Gas per ton, to be delivered, carriage paid, between the 1st of July, 1892, and the 30th of June, 1893, at the Llandudno Station of the London and North-Western Railway, in such quantities and at such periods as may be ordered from time to time.

Tenders, endorsed "Tender for Coal," to be sent to the undersigned, not later than Tuesday, the 7th of June next.

The Commissioners do not bind themselves to accept the lowest or any tender.

A. CONOLLY,
Clerk to the Commissioners.

May 19, 1892.

TENDERS FOR OLD GAS PLANT.

THE Llandudno Improvement Commissioners have FOR SALE, 20 ∩-shaped MOUTHPIECES, 19 in. by 13 in., complete with Cross-Bars, Screws, &c.; 20 ASCENSION-PIPES, 5 inches diameter, complete with Bridge-Pipes and Dips; 35 ft. 10 in. of Cast-Iron HYDRAULIC MAIN for Settings of Four Retorts in Five lengths of 7 ft. 2 in. each.

The above can be seen at the Commissioners' Gas-Works, and full particulars obtained of Mr. A. H. Smith, Gas Manager.

Tenders to be sent to me not later than Tuesday, the 7th of June next.

A. CONOLLY,
Clerk to the Commissioners.

May 19, 1892.

BURGH OF GOUROCK GAS-WORKS.

THE Gas Commissioners of the Burgh of Gourock, are prepared to receive TENDERS for the execution of certain ALTERATIONS and EXTENSIONS proposed to be made on their WORKS.

Copies of the Specification will be obtained, and relative Plans seen, at the Office of Mr. Andrew Gillespie, Gas Engineer, 34, St. Enoch Square, Glasgow, on payment of a fee of One Guinea, which will be returned on the tenders being lodged.

Sealed tenders, marked "Gas Extensions," must be lodged with the Subscriber not later than the 31st curt.

Forms of Tender will be obtained from Mr. Gillespie.

The Commissioners do not bind themselves to accept the lowest or any offer.

JAMES GLEN,
Clerk to the Commissioners.

13, Hamilton Street,
Greenock.

TO TAR DISTILLERS AND OTHERS.

THE Corporation of Birkenhead invite OFFERS for the purchase and removal of the surplus TAR produced at their Gas-Works during a period of One year, commencing on the 1st of July, 1892.

Deliveries will be made at the Gas-Works, either into Contractor's Tanks on the Gas-Works Railway Siding, or into Tanks for conveyance by road to Boats.

The Contractor whose tender is accepted will be required to enter into a formal contract or agreement with the Corporation upon the specific terms and conditions contained in the draft contract which has been prepared by the Town Clerk, and deposited in his Office for inspection.

Forms of Tender and further Particulars may be obtained from the Gas Engineer, Mr. T. O. Paterson, C.E., Gas-Works, Thomas Street.

Tenders, sealed and endorsed "Tender for Tar," to be sent in to me not later than Five p.m. on Friday, the 27th of May, 1892.

The Corporation do not bind themselves to accept the highest or any tender.

By order,
ALFRED GILL, Town Clerk.

Town Hall, Birkenhead,
May 16, 1892.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Corporation of Birkenhead invite OFFERS for the purchase and removal of the AMMONIACAL LIQUOR produced at their Gas-Works for a period of One, Three, or Five years, commencing on the 1st of July, 1892.

A Pipe is laid between the Gas-Works and the River Mersey for the conveyance of Liquor into the Contractor's Boats, or, if desired, the Corporation will provide Appliances on their own Railway Siding to pump the Liquor direct into the Contractor's Tank-Wagons.

The Contractor whose Tender is accepted will be required to enter into a formal contract or agreement with the Corporation upon the specific terms and conditions contained in the draft contract which has been prepared by the Town Clerk, and deposited in his office for inspection.

Forms of Tender and further Particulars may be obtained from Mr. T. O. Paterson, C.E., Gas Engineer, at the Gas-Works, Thomas Street.

Tenders, sealed and endorsed "Tender for Ammoniacal Liquor," to be sent to me not later than Five p.m. on Friday, the 27th of May, 1892.

The Corporation do not bind themselves to accept the highest or any tender.

By order,
ALFRED GILL, Town Clerk.

Town Hall, Birkenhead,
May 16, 1892.

MESSRS. Wheatley and Mackenzie beg to say that they have acquired the business of the late W. H. BENNETT, Esq., and that having a special experience in matters connected with Gas, Water, and Sanitary Improvement, will continue to give the same assistance to Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, or LETTERS PATENT.

Patents completed or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to WHEATLEY AND MACKENZIE, 40, Chancery Lane, LONDON, W.C.

TO TAR DISTILLERS AND MANUFACTURING CHEMISTS.

THE Directors of the Wellington (Salop) Coal and Gaslight Company invite TENDERS for the purchase of the surplus TAR to be produced at their Works for One year from the 1st of June next.

Particulars may be obtained from the undersigned, to whom tenders should be sent on or before May 28.

JNO. C. BELTON, Manager.

Gas Office, Market Street, Wellington,
Salop, May 13, 1892.

TENDERS FOR THE SUPPLY OF GAS COAL.

THE Widnes Local Board invite Tenders for the supply of about 15,000 tons of GAS COAL (Slack "through and through," or Screened Coal), to be delivered at the Gas-Works, Widnes.

Conditions and Forms of Tender may be obtained from Mr. Carr, C.E., Gas Engineer, Widnes.

Tenders to be addressed to the Chairman of the Gas Committee, endorsed "Gas Coal," and delivered to the undersigned not later than Eleven a.m. on Monday, the 30th day of May.

The Board do not bind themselves to accept the lowest or any tender.

H. S. OPPENHEIM,
Clerk.

Town Hall, Widnes,
May 12, 1892.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gas-light Company invite TENDERS for the supply of about 13,000 tons of screened GAS COALS, and about 1000 tons of good English CANNEL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the year commencing July 1, 1892, and ending June 30, 1893.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any tender.

Tenders must be made on Forms (containing further particulars), which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 17th day of June, 1892.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 18, 1892.

SHREWSBURY GASLIGHT COMPANY.

DISPOSAL OF SURPLUS TAR.

THE Directors of the above Company are desirous of receiving TENDERS for the purchase of the surplus TAR made at their Works during the year commencing July 1, 1892.

The estimated quantity for disposal is about 950 tons per annum.

Tenders must be made on Forms (containing further particulars), which may be obtained on application at the Company's Works, or by post, and must be sent in to the undersigned not later than the 17th day of June, 1892.

The Directors do not bind themselves to accept the highest or any tender.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 18, 1892.

BOROUGH OF MACCLESFIELD.

THE Gas Committee are prepared to receive TENDERS for the supply of the undermentioned MATERIALS and CARTING required during a period of Twelve months, commencing the 1st of July, 1892.

1st.—The best hand-picked BUXTON LIME, delivered fresh at Macclesfield, free from Dirt and Ashes, in such quantities as may be ordered.
2nd.—Wrought-Iron Lap-Welded STEAM-TUBES and FITTINGS.
3rd.—Cast-Iron MAINS and IRREGULARS.
4th.—OILS, PAINT, and DRUGGIST SUNDRIES.
5th.—CARTING—
(*a*) Contractors to state price per ton over the Gas Committee's Weighing-Machine from the Railway Companies' Yards and Canal Wharf, Buxton Road.
(*b*) Contractors to provide own Fillers, Horses, Carts, Shovels, Props, and all Implements; also to arrange with the Railway Companies as to Wagons being placed in position and standing under load, and be answerable for all demurrage.
(*c*) The particulars of the Wagons containing the Materials to be emptied, and any other Materials that require to be carted, will be furnished to the Contractor at the Gas Office each morning at Eight o'clock.

Any further information required can be obtained on application to Mr. Ford, Engineer, Gas-Works.

Sealed tenders, properly endorsed, to be addressed to the Chairman, Gas Committee, Town Hall, Macclesfield, and to be sent in not later than Saturday, the 11th of June, 1892.

The Committee do not bind themselves to accept the lowest or any tender.

(Signed) W. FREDK. TAYLOR,
Town Clerk.

May 9, 1892.

GAS COAL.

THE Directors of the Dundalk Gas Company invite TENDERS, on or before the 1st of June, for the supply of from 1000 to 2000 tons of best GAS COAL.

Particulars may be obtained from

JOSEPH A. COULTER.
Secretary.

May 12, 1892.

TO WELDED TUBE MAKERS.

THE Corporation of Halifax are pre-pared to receive TENDERS for the supply of 70 ASCENSION-PIPES, each 9 in. external diameter and 9 ft. 10½ in. long. The internal diameter must be 8½ inches, and the one Flange be 15½ in. diameter, with six Bolt Holes at 13-inch centres. The Flange must be securely screwed upon the Pipe.

Delivery to be free at Halifax.

THOS. HOLGATE,
Gas Engineer.

Halifax, May 17, 1892.

THE East Dereham Local Board are prepared to receive TENDERS for the supply of about 1200 tons of screened GAS COAL for the ensuing year.

Conditions and forms of tender to be had of the undersigned.

Tenders to be sent in by May 30, 1892.

B. H. VORES,
Clerk to the Local Board.

East Dereham,
May 21, 1892.

BOROUGH OF WARRINGTON.

TENDERS FOR VALVES AND MAINS.

THE Gas Committee invite Tenders for 16-inch GAS GOVERNOR VALVES and various MAINS.

For further particulars, apply to the Manager, Mr. W. S. Haddock.

FREDK. TAYLOR,
Secretary.

Gas Offices, Warrington,
May 23, 1892.

TYNEMOUTH GAS COMPANY.

THE Directors of the Tynemouth Gas Company invite TENDERS for the Construction of two SCRUBBERS, with Mains, Valves, &c.

Drawing and Specification may be seen at the Company's Works, North Shields.

Tenders, endorsed "Tender for Scrubbers," to be sent in on or before June 1, 1892.

The Directors do not bind themselves to accept the lowest or any tender.

W. HARDIE, jun.,
Engineer.

Gas-Works, North Shields,
May, 1892.

HORSHAM GAS COMPANY, LIMITED.

TENDERS FOR COAL AND CANNEL.

THE Directors of the Horsham Gas Company, Limited, invite TENDERS for the supply of about 3000 tons of SOUTH YORKSHIRE DOUBLE-SCREENED GAS COAL, and about 150 tons of WELL-SCREENED CANNEL, producing about 11,000 cubic feet of 30-candle Gas per ton, and a good saleable Coke.

Both Coals must be free from Bats and Sulphurous Pyrites, or other objectionable matter.

Tenders, stating the price per ton of 20 cwt., delivered free in the Goods Yard, Horsham Station, to be sent to me, the undersigned, on or before Friday, the 10th of June, 1892, and endorsed "Tender for Coal and Cannel."

The Directors do not bind themselves to accept the lowest or any tender.

E. D. SAPEY,
Manager.

Gas Offices, Horsham,
May 18, 1892.

SUTTON-IN-ASHFIELD LOCAL BOARD.
(GAS DEPARTMENT.)

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the Sutton-in-Ashfield Local Board are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works from July 1 to Dec. 31, 1892.

Particulars may be obtained on application to the Manager, at the Gas-Works, Sutton-in-Ashfield, Notts.

Tenders, stating price per ton of 20 cwt. at the Works, or at Sutton-in-Ashfield Railway Station, to be addressed to the Clerk to the Local Board, Local Board Offices, Sutton-in-Ashfield, and marked "Tender for Tar and Liquor," so as to arrive not later than Tuesday, the 31st day of May, 1892.

By order,
G. H. HIBBERT,
Clerk to the Committee.

Local Board Offices, Sutton-in-Ashfield, Notts.

SUTTON-IN-ASHFIELD LOCAL BOARD.
(GAS DEPARTMENT.)

SUPPLY OF GAS COAL.

THE Gas Committee of the above Local Board are prepared to receive TENDERS for the supply of 1400 tons of well-screened GAS COAL, to be free from Shale and Pyrites, and to be delivered at the Railway Station, Sutton, in such quantities as the Manager shall from time to time direct, between July 1 and Dec. 31, 1892.

Particulars may be obtained on application to the Manager, at the Gas-Works, Sutton-in-Ashfield, Notts.

Tenders, stating price, to be addressed as above, and marked "Tender for Coal," so as to arrive not later than Tuesday, the 31st day of May, 1892.

By order,
G. H. HIBBERT,
Clerk to the Committee.

Local Board Offices, Sutton-in-Ashfield, Notts.

LURGAN GAS, LIGHT, AND CHEMICAL COMPANY, LIMITED.

TENDERS FOR COAL.

THE Directors are anxious to procure TENDERS for the supply of 2500 tons of best screened GAS COAL, delivered into Lighters *ex* Ship, at Belfast, free of all charges.

Delivery of 2000 tons will be taken before the 1st of November next: the remainder to be delivered at such times before the 1st of March, 1893, as may be required.

Vessels carrying from 200 to 300 tons can at once deliver into Lighters; and these Lighters be back for a further Cargo within a period to be arranged.

Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Ten o'clock in the Forenoon of Monday, the 6th of June next.

The Directors do not bind themselves to accept the lowest or any tender.

FRED. W. MAGAHAN,
Secretary.

Gas-Works, Lurgan,
May, 1892.

BOROUGH OF BURTON-UPON-TRENT.

TO COLLIERY PROPRIETORS.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, are prepared to receive TENDERS, from Colliery Proprietors only, for the supply of from 1000 to 24,000 tons (21 cwt. to the ton) of best screened GAS COAL, to be delivered, in Sender's or Railway Company's Trucks, at the Gas-Works Railway Siding, Burton-upon-Trent, between the 1st day of July next, and the 30th day of June, 1893.

The deliveries are to be made in such quantities and at such times as may be directed by the Manager.

Payments, net cash Monthly.

Tenders, enclosed in an envelope, sealed and endorsed "Tender for Coal," are to be delivered to me at or before Ten a.m., on Friday, the 27th of May inst.

The Council do not bind themselves to accept the lowest or any tender.

F. L. RAMSDEN,
Manager and Engineer.

Gas-Works, Burton-upon-Trent,
May 4, 1892.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 45,000 tons of best well-screened large GAS COAL, to be delivered between July, 1892, and June 30, 1893, in monthly quantities, in accordance with the Specification.

Parties tendering may do so for the whole quantity or for quantities from 5000 tons upwards.

Forms of Tender and Specification of monthly deliveries may be obtained on application to Mr. H. Morley, the Company's Engineer.

Sealed tenders to be sent to the undersigned not later than Thursday, the 2nd day of June next, addressed to the Chairman of the Company, and endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order
GEORGE CLARRY,
Secretary.

Gas Offices, Cardiff,
April 30, 1892.

MANCHESTER CORPORATION GAS-WORKS.

SPENT OXIDE.

THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the Purchase and Removal of the SPENT OXIDE to be produced at their Gaythorn, Rochdale Road, and Bradford Road Works during a period of One, Two, or Three years from the 30th of June next.

The Committee do not bind themselves to accept the highest or any tender.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Spent Oxide," must be delivered at the Offices of the Gas Department, Town Hall, on or before Thursday, the 2nd day of June next.

Forms of Tender and further Particulars may be obtained on application in writing to Mr. Charles Nickson, Superintendent of the Gas Department.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, May 13, 1892.

COUNTY BOROUGH OF ST. HELENS.

GAS COALS.

THE Gas Committee of the Corporation invite TENDERS for the supply at their Works of COAL and CANNEL for Gas-Making purposes for One year and for Two years, to commence the 1st of July, 1892.

Forms of Tender with all particulars may be obtained on application to Mr. Samuel Glover, Gas Engineer, St. Helens.

Tenders on such forms, addressed to the Chairman of the Gas Committee, Warrington Old Road, St. Helens, and endorsed "Coal" or "Cannel," as the case may be, must be delivered by the 7th of June next.

The Committee do not bind themselves to accept the lowest or any tender.

WM. JNO. JEEVES,
Town Clerk.

Town Hall, St. Helens,
May 20, 1892.

STEAM-PUMPS.

THE Brighouse Local Board are prepared to receive DESIGNS and TENDERS for the supply of Three STEAM-PUMPS for Tar and Ammoniacal Liquor, delivered and fixed at their Gas-Works, Brighouse.

Particulars can be obtained on application to the undersigned.

Sealed tenders, addressed to Frederick Laxton, Esq., Chairman of the Local Board, Public Offices, Brighouse, are to be sent in on or before Tuesday, the 31st day of May, 1892, endorsed on the outside, "Tender for Steam-Pumps."

The Board do not bind themselves to accept the lowest or any tender.

By order,
JAMES PARKINSON,
Engineer.

Public Offices, Brighouse,
May 14, 1892.

COUNTY BOROUGH OF BURNLEY.

(GAS DEPARTMENT.)

THE Gas Committee of the Corporation of Burnley are prepared to receive TENDERS for WROUGHT-IRON STAGE-FLOORS and COAL-HOPPERS in the No. 3 Retort-House at their Lane Bridge Gas-Works.

Specifications and Forms of Tender can be obtained, and the Drawings inspected, on application to Mr. Jno. P. Leather, at the Gas-Works.

Tenders, sealed, and endorsed "Tender for Ironwork," to be sent in, addressed to the Chairman of the Gas Committee, Town Clerk's Office, Town Hall, Burnley, on or before Wednesday, the 25th of May, 1892.

By order,
JNO. P. LEATHER,
Gas Engineer.

CITY OF BIRMINGHAM.

TENDERS FOR AMMONIACAL LIQUOR.

THE Gas Committee invite Tenders for the purchase of the AMMONIACAL LIQUOR produced at their Works during a period of Ten years beginning on July 1, 1893.

The quantity produced in the year ended March 31 1891, was 13,682,000 gallons of 10-oz. Liquor.

Provision may be made for dealing with the Liquor either in Works now erected on Land belonging to the Corporation, or on Land to be let for the erection of new Works.

Copies of the conditions on which tenders are invited may be obtained on application to

EDWIN SMITH,
Secretary.

City Gas Offices, Council House,
Birmingham.

ACCRINGTON GAS AND WATER WORKS COMPANY.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Directors invite Tenders for the purchase of the TAR and AMMONIACAL LIQUOR which may be produced at their Accrington and Great Harwood Works during a period of One year, commencing on the 1st of July next.

The quantity will be about 1300 tons of Tar and 3000 tons of Liquor (10-oz.).

Tenders, addressed to the Chairman, Offices of the Company, St. James's Street, Accrington, must be in my hands not later than Wednesday, the 8th of June.

By order,
CHAS. HARRISON,
Secretary and Manager.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 20,000 tons of CANNEL, best well-screened GAS COAL, and NUTS, to be delivered between the 1st of July, 1892, and the 30th of June, 1893.

Forms of Tender and Specification may be obtained on application to the undersigned.

Sealed tenders to be sent to the Chairman of the Company, not later than the 1st day of June next, endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

By order,
W. DUESBURY, Manager.

Gas-Works, Cambridge,
May 7, 1892.

THE Goole and District Gas and Water Company are prepared to receive TENDERS for the supply of from 3500 to 4000 tons of best screened GAS COAL during a period of Twelve months from July 1 next.

Tenders to state price per ton of 21 cwt., delivered alongside the Aire and Calder Navigation Basin, or at the Bridge Street Siding of the Lancashire and Yorkshire Railway Company, Goole.

Particulars of Contract can be obtained at the Company's Office, Goole.

Sealed tenders, endorsed "Gas Coal," to be delivered to the undersigned on or before Saturday, May 28.

The Directors do not bind themselves to accept the lowest or any tender, but reserve to themselves the right to divide the contract.

W. OLDFIELD,
Manager.

Gas Office, Goole,
May 14, 1892.

C. & W. WALKER'S
GASHOLDERS; PURIFIERS;
PURIFYING MACHINES;

CO_2 AND TAR-EXTRACTING WASHERS; SCRUBBERS;

SULPHATE & SULPHUR PLANT;

PATENT SELF-SEALING RETORT MOUTHPIECES;

LIFTING APPARATUS; CENTRE AND FOUR-WAY VALVES;

SOLE MANUFACTURERS OF WECK'S PATENT CENTRE-VALVE;

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SLIDE VALVES; TAR BURNERS; &C., &C.

WOOD SIEVES.

ADDRESSES:

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"FORTRESS DONNINGTON." "FORTRESS LONDON."—Telegraphic."

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

TO THE SHAREHOLDERS.

NOTICE is hereby given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices, 60, Gracechurch Street, London, E.C., on Tuesday, the 7th of June, 1892, at Twelve o'clock at Noon, for the purpose of receiving the Report of the Directors and the Accounts for the Year ended the 31st of March, 1892, and for the transaction of the General Business of the Company.

One of the Directors, Colonel James Le Geyt Daniell, will retire from office, but offers himself for re-election.

The Auditors, Robert Hesketh Jones and Thomas Guyat, Esqs., will retire from office, but are eligible for re-election.

The Transfer Books will be closed from the 24th of May until the day of the meeting, both days inclusive.

By order,
A. W. COOPER,
Secretary.

60, Gracechurch Street, E.C.,
May 10, 1892.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

ADDRESS

JAMES WHITE & Co., Limited,
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COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

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PARK STREET, SOUTHWARK, E.C.

TO GASHOLDER MAKERS.

THE Gas Committee of the Tipton Local Board are prepared to receive TENDERS for REPAIRS, &c., to a 70 feet diameter TWO-LIFT GASHOLDER.

Drawings and Specification may be seen at the Gas-Works on application to the undersigned.

Tenders to be sent in not later than the 28th inst.

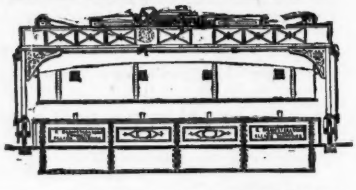
VINCENT HUGHES,
Engineer and Manager.

Gas Offices, Tipton,
May 17, 1892.

EIGHTH EDITION, REVISED AND ENLARGED.
Just published, Fcap. 8vo, 5s. 6d. Cloth Limp, or 6s. Cloth Boards.

GAS-WORKS: Their Construction and Arrangement, and the Manufacture and Distribution of Coal Gas. By S. HUGHES. Eighth Edition. Revised, with Notices of Recent Improvements. By WM. RICHARDS, C.E.
London: CROSBY LOCKWOOD & SON, 7, STATIONERS' HALL COURT, E.C.

DEMPSTERS'



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TAR, LIQUOR, AND SPENT OXIDE
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Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
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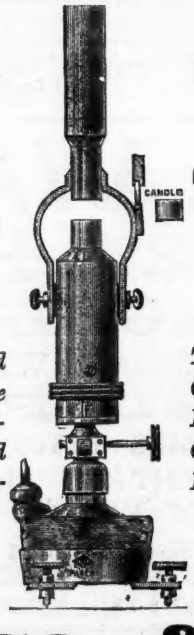

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Yield of Gas per ton	13,155 cub. ft.
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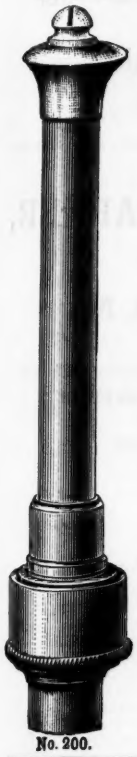

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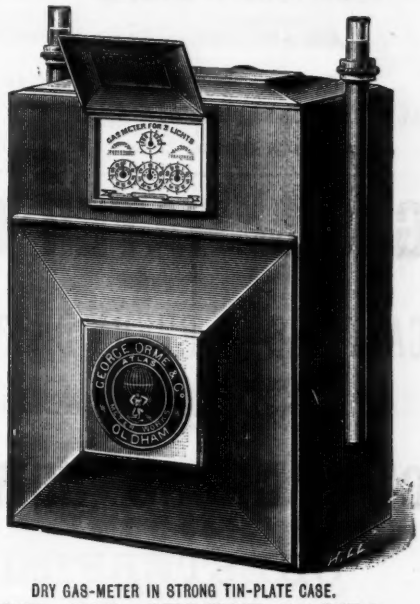
WET GAS-METER IN CAST-IRON CASE.



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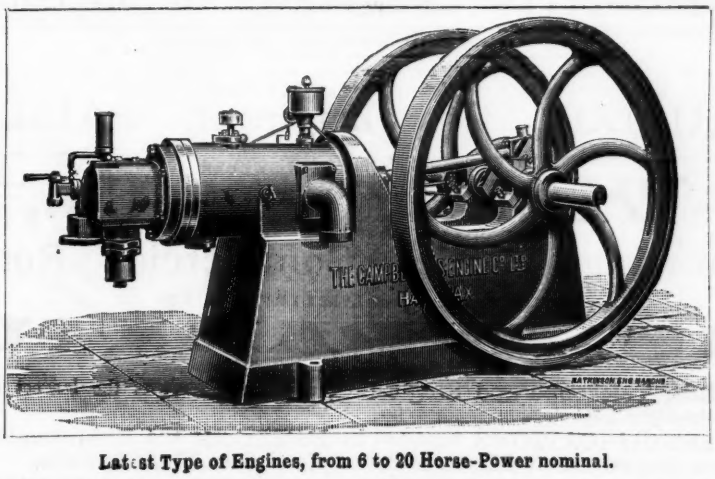

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Geo. R. HISLOP, Gas Engineer, PAISLEY, N.B.

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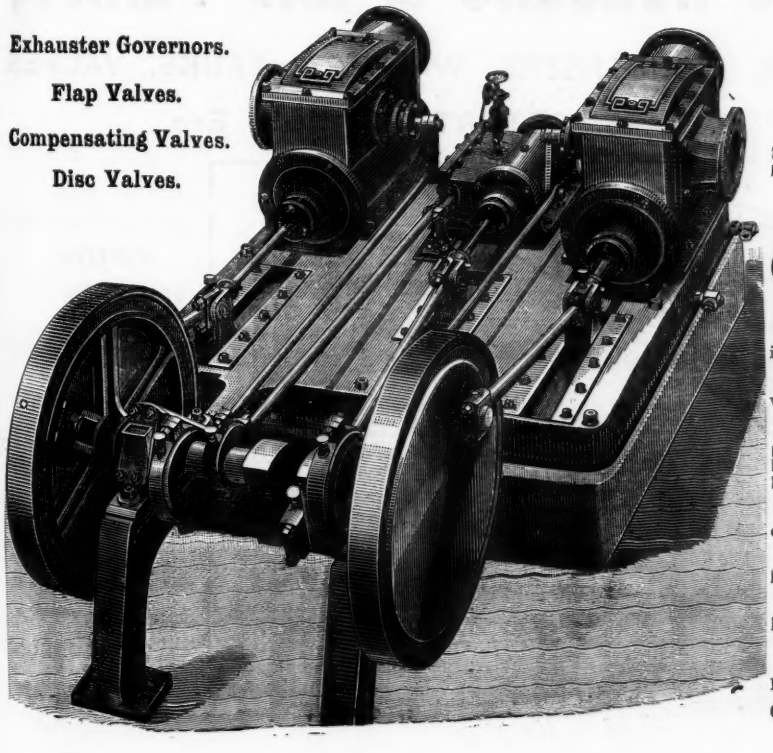

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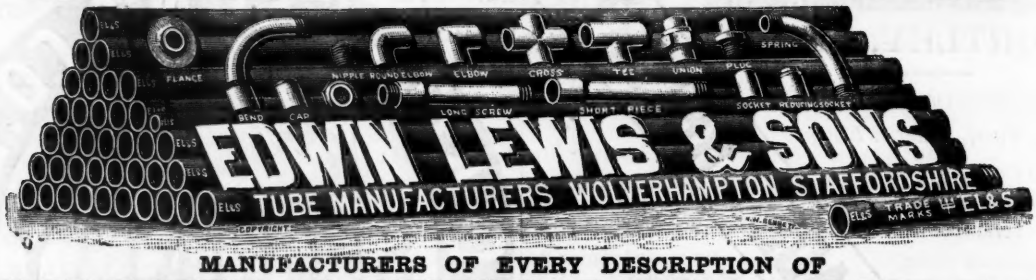

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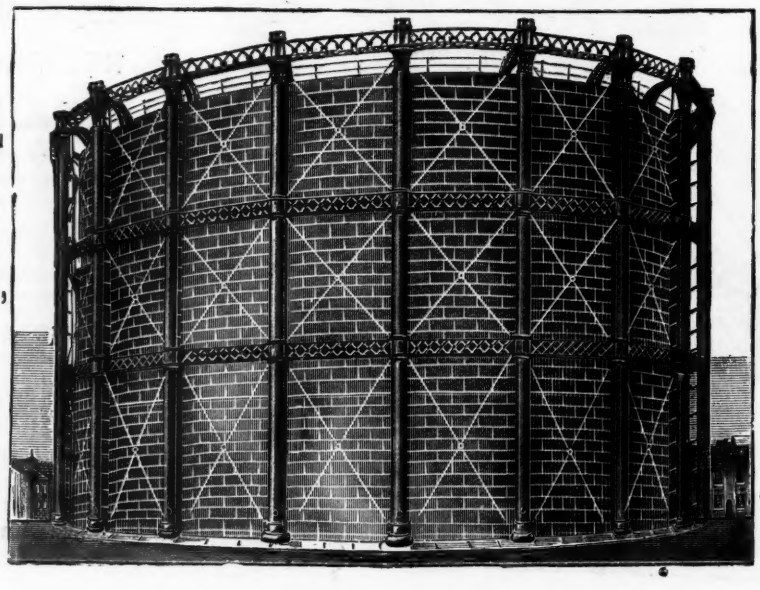

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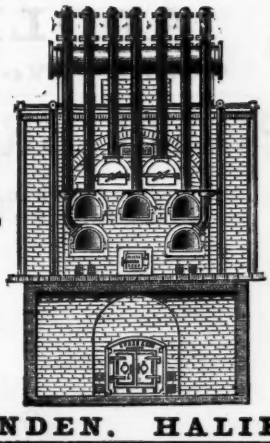

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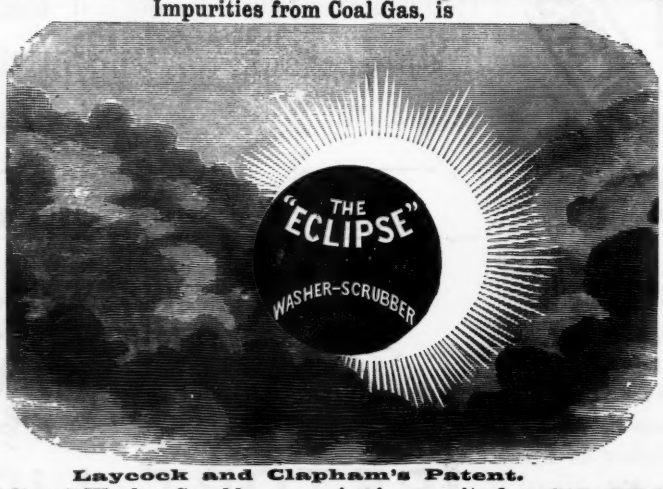

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